July 2000

ASSESSMENT OF SALMONID FISHES AND THEIR HABITAT CONDITIONS IN THE WALLA WALLA RIVER BASIN OF WASHINGTON

Annual Report 1999

DOE/BP-07035-2

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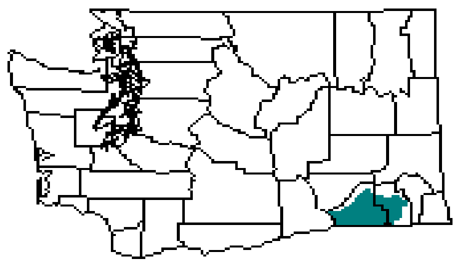
Assessment of Salmonid Fishes and Their Habitat Conditions in the Walla Walla River Basin of Washington:

1999 Annual Report



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We appreciate the assistance from the WDFW Snake River Lab. They shared equipment and provided us with some data and DNA samples from the Touchet River, as well as assisted with some electrofishing and spawning surveys. Other WDFW personnel also provided valuable assistance. John Skidmore, Mike "Clem" Gembala, Annie Dowdy, Kristen Lyonnaise, Jeff McCowen, Jason Norris, and Justin Steinhoff assisted with data collection and data entry.

Bill Neve and John Covert (DOE) provided valuable assistance both establishing and operating the constant recording stream flow monitors. Jon Germond (ODFW) and his staff collected DNA samples from steelhead and bull trout in the upper Walla Walla River. Thanks to W. S. "Wib" Wagoner for operating the adult steelhead trap on Yellowhawk Creek. Jim Shaklee was in charge of DNA analyses. We thank them all.

Craig Rabe, Joe Bumgarner, Ben Tice, Bill Neve, John Covert and Charlie Craig reviewed a draft of this report and provided comments for revisions. We appreciate their assistance in preparation of this report.

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Introduction

Concerns about the decline of native salmon and trout populations have increased among natural resource managers and the public in recent years. As a result, a multitude of initiatives have been implemented at the local, state, and federal levels of government. These initiatives include management plans and actions intended to protect and restore salmonid fishes and their habitats.

In 1998 bull trout were listed under the Endangered Species Act (ESA), as "Threatened", for the Walla Walla River and its tributaries. Steelhead trout were listed as "Threatened" in 1999 for the mid–Columbia River and its tributaries. The ESA listings emphasize the need for information about these threatened salmonid populations and their habitats.

The Washington Department of Fish and Wildlife (WDFW) is entrusted with "the preservation, protection, and perpetuation of fish and wildlife....[and to] maximize public recreational or commercial opportunities without impairing the supply of fish and wildlife (WAC 77.12.010)." In consideration of this mandate, the WDFW submitted a proposal in December 1997 to the Bonneville Power Administration (BPA) for a study to assess salmonid distribution, relative abundance, genetics, and the condition of their habitats in the Walla Walla River basin.

The primary purposes of this project are to collect baseline biological and habitat data, to identify major data gaps, and to draw conclusions whenever possible. The study reported herein details the findings of the 1999 field season. The field season extended from March to November, 1999. The study is proposed to continue through 2002.

Background

The Walla Walla River and its major tributaries, including the Touchet River, comprise a watershed of 1,758 square miles (ACOE 1997) and 2,454 major stream miles (Knutson et al. 1992). The majority of the watershed (73%) lies within Washington State, with the remainder in Oregon (Figure 1). The Walla Walla River originates from a fine network of deeply incised streams on the western slopes of the Blue Mountains. The Touchet River originates from similar streams on the northwestern slopes of the Blue Mountains, and also from seasonal streams draining Palouse hillsides to the north. The Walla Walla River drains into the Columbia River near Wallula Gap, about 21 miles above McNary Dam and 6 miles above the Oregon border. The Touchet River drains into the Walla Walla River just west of the town of Touchet, WA.

Historic and contemporary land–use practices have had a profound impact on the salmonid species abundance and distribution in the watershed. Fish habitat in area streams has been severely degraded by urban and agricultural development, grazing, tilling, logging, recreational activities, and flood control structures. Agricultural diversions have severely impacted stream flows in the Walla Walla River since the 1880s (Neilson 1950). Nearly all (99%) of the surface water diversions within Washington are for the purpose of irrigation (Pacific Groundwater Group

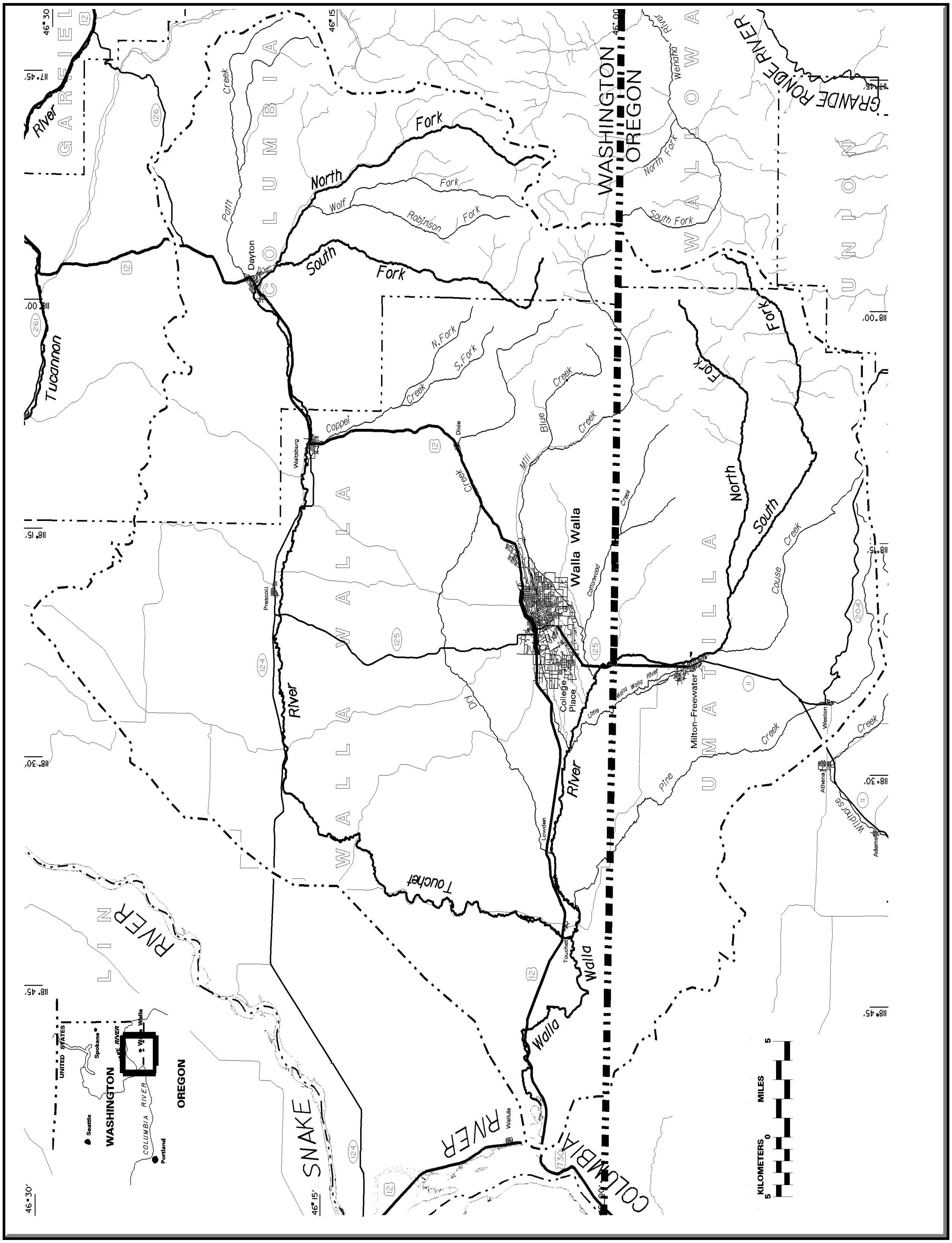


Figure 1. Walla Walla River watershed (modified from map courtesy of USACE, Walla Walla District).

1995). The reduced stream flows created by irrigation withdrawals adversely impact salmonid survival within the basin.

Additionally, out-of-basin impacts to local fish populations have been substantial. Salmon migrating to or from the ocean must pass through four dams and reservoirs on the Columbia River before reaching their destination. Juvenile and adult salmonid mortalities occur as they pass through each reservoir or dam. Other past out-of-basin impacts include over-harvest, habitat destruction in the lower Columbia River and estuaries, predation, unscreened and poorly screened diversions throughout the system, and industrial pollution.

Historically the basin probably produced substantial runs of both spring chinook and summer steelhead. The last substantial run of wild chinook took place in 1925; thereafter chinook populations continued a precipitous decline, and the species is considered extirpated in the basin (Nielson 1950, ACOE 1997). Chum and coho salmon may have also occurred in the drainage before the early 1900's, but little written documentation exists. Anecdotal accounts and reports of historic fisheries in adjacent basins, indicate that chum and coho could have occurred in substantial numbers in the Walla Walla Basin (Pirtle 1957). Endemic steelhead persist throughout much of the basin, but the population is considered depressed (WDF and WDW 1993). Annually, approximately 300,000 non-endemic hatchery steelhead (Lyons Ferry stock) are released in the middle Touchet and lower Walla Walla rivers under the Lower Snake River Compensation Program (LSRCP) to provide harvest mitigation for the four lower Snake River dams.

Not all native salmonids in the basin are anadromous. Whitefish, bull trout and rainbow/redband trout exist within the basin. However, only rainbow/redband trout retain a wide distribution throughout the watershed. In the past, bull trout are thought to have been widely distributed in the basin. Currently, bull trout distribution is generally limited to montane upper tributaries of the Touchet River, Walla Walla River, and Mill Creek (Mongillo 1993). However, bull trout are known to migrate into the middle or lower reaches of these rivers during the winter months. Many factors have led to the decline of bull trout in southeast Washington. Damaged riparian vegetation, increased sedimentation, and decreased water flows have resulted in elevated water temperatures beyond the tolerance of this cold water species (Mongillo,1993). Introduced rainbow trout or brown trout may have increased competition or predation for bull trout.

Several non-native fish species have been introduced to support recreational fishing, or they have strayed into the basin. The Washington Department of Game (now WDFW) began stocking brown trout (*Salmo trutta*) in the Touchet River in the 1960s. Stocking was discontinued in 1999 due to concerns about competition, hybridization, and predation with native bull trout and steelhead. Carp were introduced as early as 1884 (Walla Walla Daily Journal 1884). Channel catfish, smallmouth bass, and bluegill are some of the warm water fish that now occur in the lower basin. In 1998, WDFW personnel surveying the river as part of this project found Tadpole madtoms *(Noturus gyrinus)* in the lower Walla Walla River. The Tadpole madtom is a small catfish indigenous to some Atlantic and Gulf drainages. They were first collected in the Snake

River in 1942, possibly introduced with a shipment of channel or bullhead catfish (Wydoski and Whitney 1979). Additionally, in 1999, three-spine stickleback *(Gasterosteus aculeatus)* were found in the Walla Walla river by WDFW personnel working with this project.

Study Purpose and Objectives

The purpose of the study is to determine fish passage, rearing, and spawning conditions for steelhead and potential reintroduction of chinook salmon, and to assess steelhead and bull trout distribution, densities, habitat, and genetic composition in the Walla Walla watershed.

Specific objectives and tasks were outlined in WDFW's proposal and statement of work to the Bonneville Power Administration (BPA Project # 98020-00). Some tasks had to be scaled back or postponed. Multi–year study objectives include:

1. Assess baseline habitat conditions for salmonids in the Washington portion of the Walla Walla watershed;
2. Determine salmonid distribution and relative abundance in the Washington portion of the Walla Walla watershed; and
3. Identify genetic stocks of steelhead and bull trout in the Walla Walla watershed.

Specific objectives and tasks were outlined in the statement of work. Tasks included:

- Establish constant recording temperature and flow monitors in the Walla Walla River basin, to identify available water for salmon passage and rearing, as well as temperature limitations for salmonid passage, spawning and rearing;
- Conduct an Instream Flow Incremental Methodology (IFIM) study, in order to quantify available habitat as it relates to stream discharge (flow);
- Conduct biweekly manual stream flow and temperature measurements to calibrate instream monitor data outputs, and to provide data for reaches that did not have instream discharge monitors;
- Monitor water quality by sampling dissolved oxygen, pH, turbidity, and conductivity;
- Conduct electrofishing to determine salmonid distribution, abundance, and habitat use;
- Conduct snorkel surveys during the spring and summer to supplement electrofishing data and for seasonal density comparisons;
- Conduct periodic flights of the lower Walla Walla and Touchet Rivers to determine continuity of stream flows for adequate fish passage and rearing;
- Conduct general habitat surveys in portions of the stream with potential for salmonid use to quantify habitat conditions and identify limiting factors (This task is scheduled for 2000);

- Conduct steelhead and bull trout spawning surveys to determine spawning timing and distribution, and to establish an index of relative abundance; and
- Collect tissue samples from bull trout and steelhead for genetic analyses.

Methods

Study Area

The study area encompasses the greater Walla Walla River basin in Washington State (Figure 1). The Walla Walla River, the Touchet River, and Mill Creek are the major rivers within the basin. The main stem Walla Walla River and the Touchet River and its tributaries, were the primary study reaches in 1999.

Stream Reaches

Representative stream reaches were identified based on general physical characteristics and readily identifiable landmarks (Appendix A). General physical characteristics included: slope, width, depth, and temperature; as well as, predominant adjacent land uses. Landmarks included towns, roads, and bridges.

Individual Site Selection

Most of the study streams are in private ownership, therefore it was necessary to obtain permission from landowners to access potential sites. Owners of property bordering the study streams were identified from county assessment records and contacted in person or by telephone. For convenience, public land was utilized whenever possible. Study sites were distributed to comprehensively cover the study area. In Appendix A, sites are listed from upstream to downstream, including stream reach, site number, township-range-section-1/4 section-1/16 section, river mile, type of sampling, and comments.

River miles were determined by measuring 1:24000 USGS topographic maps with a map wheel. River miles were determined by measuring the distance between the confluence of each stream and the study site. These locations should be considered approximate due to the limited precision of this method.

Electrofishing sites were selected randomly from access areas. Selections of top and bottom net locations were also randomized. Site lengths sometimes had to be modified to avoid unsuitable stream features, such as deep pools, rapids, multiple channels, and/or safety concerns.

Snorkeling sites were designed to extend and compliment the area initially surveyed by electrofishing. Sites were located using the same randomization process used for establishing electrofishing sites.

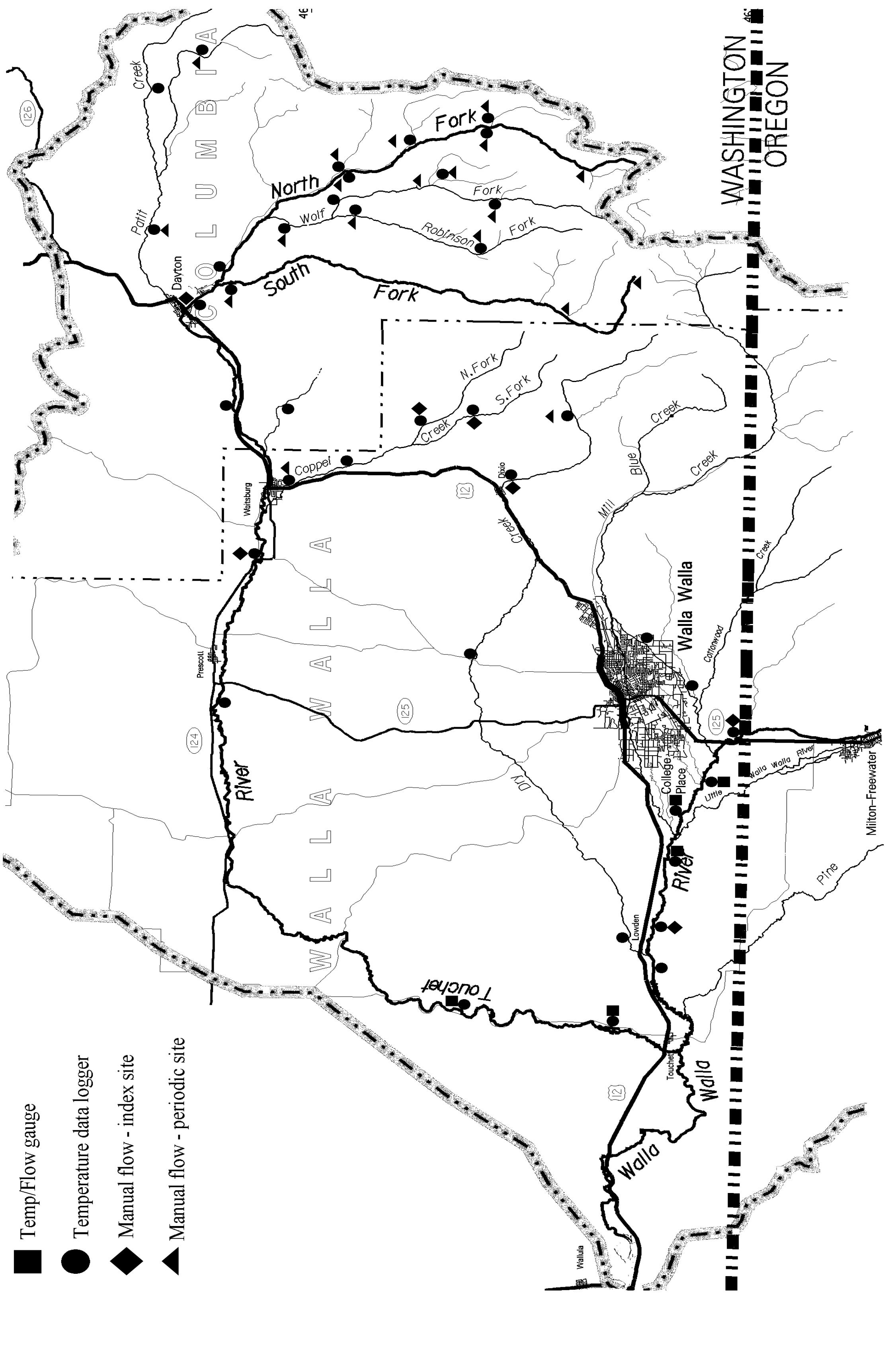


Figure 2. Relative locations of temperature and flow monitoring sites in the Walla Walla Basin, 1999.

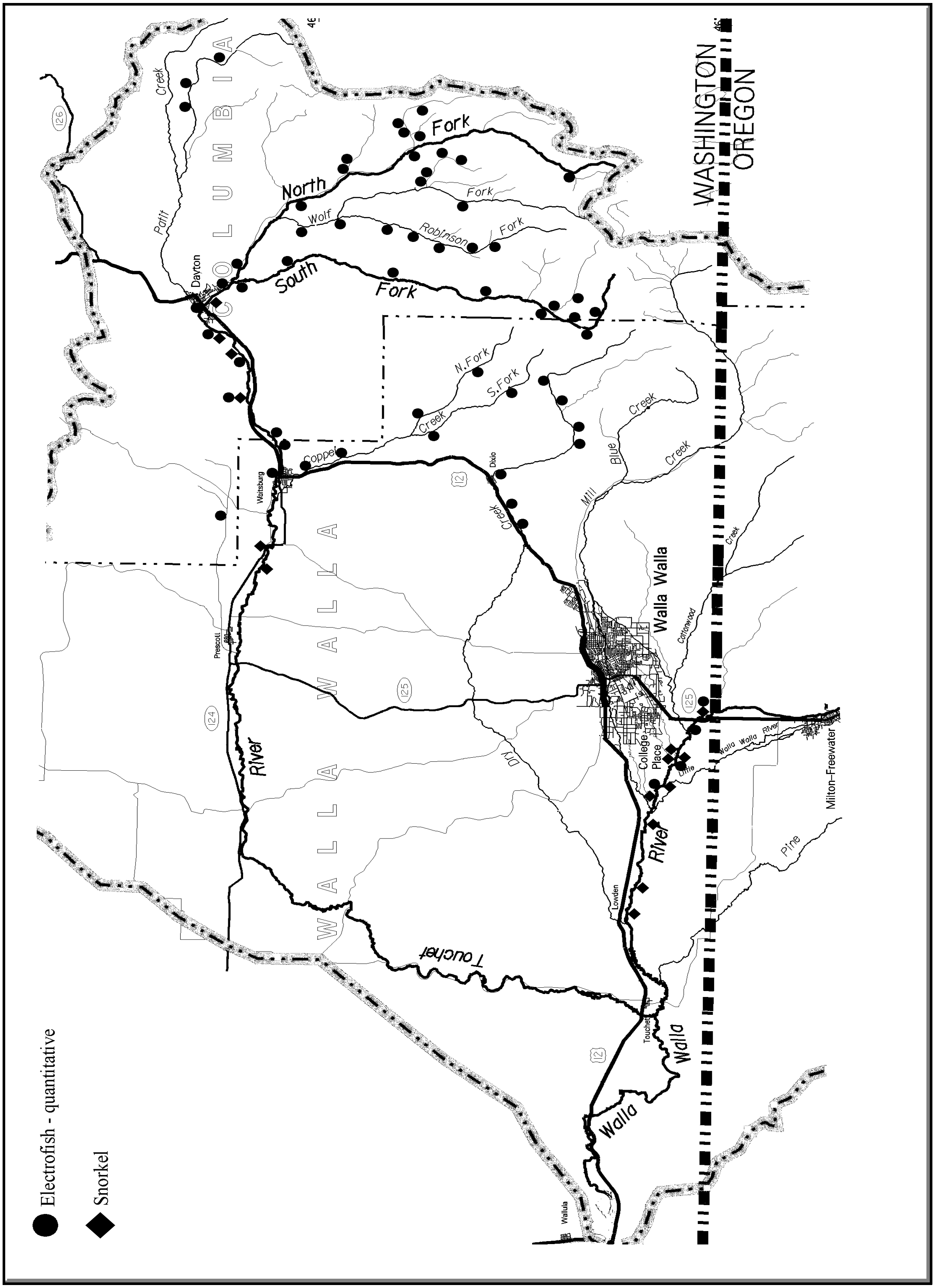


Figure 3. Relative locations of quantitative electrofishing and snorkeling in the Walla Walla Basin, 1999.

Habitat Assessment

Stream Flows

Stream discharge was measured using two methods. Manual flow measurements were taken biweekly at selected sites according to standard techniques (Armour and Platts 1983) using a Swoffer model 2100 flow meter. Discharge was calculated in cubic feet per second (cfs) with Quattro Pro© spreadsheets. The second method involved the use of continuous flow data loggers (Unidata America, Model KB/DSP 128K). The monitors were placed at three sites on the Walla Walla River, and two sites on the lower Touchet River (Appendix A, Figure 2). WDFW contracted with the Washington Department of Ecology (WDOE) to maintain the monitors and collect the data. Manual flow measurements were taken by WDFW near each of the flow monitors to correlate the discharge and stage readings recorded by the monitors. Index and periodic discharge sites are listed for the Walla Walla River basin (Appendix A, Figure 2).

IFIM - We subcontracted with Hal Beecher (WDFW) and Brad Caldwell (WDOE) to conduct an IFIM study on the Walla Walla River and lower Mill Creek in 1999. Results will be provided in a future report.

Stream Temperatures

We used three methods to collect water temperatures. Water temperature (°F) was measured at each site using standard field thermometers. Manual temperatures were taken during all data collecting activities. The second method involved the use of temperature data loggers (Onset Corporation, Optic StowAway, or Tidbit Temp Data Logger®), which were set to continuously measure temperatures in °F at 30 minute intervals. The monitors were placed at sites throughout the Walla Walla River basin (Appendix A, Figure 2). WDFW maintained the temperature monitors and downloaded the data using an Optic Stowaway Shuttle®. Temperature data were exported from Onset Boxcar 3.5 software into Quattro Pro spreadsheets. Daily minimum, maximum, and mean temperatures were prepared using a Quattro Pro macro (Mendel, 1999).

The accuracy of field thermometers and data loggers was evaluated using a laboratory calibrated thermometer (Kessler Instruments). The third method involved the use of continuous flow and temperature data loggers (Unidata America, Model KB/DSP 128K). The monitors collect both stream discharge (stage value) and temperature data every 15 seconds and stores the data every four hours as averages for discharge and minimum, maximum, and mean temperatures. The monitors were used to collect temperatures as a substitute for the stowaway temperature loggers at their respective sites (Appendix A, Figure 2). We contracted with the WDOE to maintain the monitors and provide the data to us.

Water Quality

WDOE has conducted water quality monitoring at established sites since 1959, and continously on the Walla Walla river at Cummings Bridge since 1971. In 1999, we contracted with WDOE to collect water quality data at three additional sites in the Walla Walla and Touchet Rivers. New sites were located at Detour Road Bridge on the Walla Walla River, Bolles Bridge, and Simms Road Bridge on the Touchet River. Sampled water quality variables included water temperature (C), conductivity (umhos/cm), dissolved oxygen (mg/L), percent oxygen saturation, pH, fecal coliforms (#/100ml), suspended solids (mg/L), total persulfate nitrogen (mg/L), ammonia nitrogen (mg/L), total phosphorus (mg/L), turbidity (NTU), nitrate-nitrite (mg/L), and dissolved soluble phosphorus (mg/L). Miscellaneous water quality data were collected by WDFW during the 1999 field season.

Limiting Factor Identification

One of the study goals was to identify and document physical barriers to salmonid passage, spawning and rearing. Field personnel noted the presence of potential barriers and provided the information to local biologists to coordinate habitat rehabilitation efforts. The activity of two major irrigation diversion structures, Hofer Dam on the Touchet River, and Burlingame Diversion on the Walla Walla River, were also noted throughout the season.

Physiological barriers to salmonid passage and survival, in the form of excessive temperatures, inadequate flows, and degraded habitat were also identified by examining tables and graphs of data collected by instream monitors and manual sampling. Maximum temperatures, as well as the number of days with temperatures exceeding 75°F (lethal to salmonids if prolonged), and presence or absence of salmonid fishes at study sites, were factors taken into consideration.

On August 18, 1999, WDFW conducted an aerial survey of water continuity throughout most of the Walla Walla River, Whiskey Creek, and Dry Creek. The flight followed the mainstem Walla Walla River from Nursery Bridge, upstream of the Oregon state line, to the mouth of the Touchet River. The condition of mainstem tributaries, such as Russell Creek, Reser Creek, and Dry Creek were observed. The flight also covered the lower reaches of Mill and Yellowhawk Creeks, which are major tributaries to the Walla Walla River, and flow through the City of Walla Walla. Sections of the Touchet River were also surveyed, including most of Whiskey Creek.

Fish Stock Assessment

Distribution and Abundance

Electrofishing

A Smith-Root Model 11A or 12B electrofishing backpack unit was used to collect fish so we could calculate densities at various study sites in the Walla Walla basin (Figure 3). We used pulsed DC between 400 and 600 volts. Sites were delimited by block nets spanning the channel, placed approximately 30 meters apart. Block nets prevented fish from entering or leaving the site, so that fish population density could be calculated (Platts et al. 1983). The operator generally began at the upstream net and worked downstream, covering the entire wetted width. A "pass" was completed when the downstream net was reached. All sites received at least two sequential passes. A 60% reduction was required between the first and second passes for each salmonid species and age class. If the reduction was not met, a third pass was usually conducted. Fish were collected with dip nets and placed in buckets until they could be sampled for lengths and weights. Collected fish were anesthetized with FINQUEL® (MS-222 tricaine methane sulfonate), identified, weighed (g), and measured using fork length (mm).

Fork lengths collected during quantitative electrofishing were used to create length frequency histograms. The histograms were used to determine age classes (Mendel et al. 1999). These age class delineations were checked against ages determined from reading fish scales that were collected from several of the stream reaches. Age class groupings were specific for each stream reach.

A removal–depletion software program developed by the U.S. Forest Service (Van Deventer and Platts, 1983) was used to calculate population densities (#/100 m^2) for each salmonid species, by age class. The average weight (grams) of each age class was multiplied by its density to calculate biomass (g/100 m^2) per age class.

Area sampled was determined by multiplying site length by the average site width. A brief description of the riparian, bank stability, substrate, pools/riffle ratio, and the presence of large organic debris (LOD) was recorded for each site.

Fish identification included genus and species for all Salmonids, Cottids, and *Cyprinidae*, and genus only for *Catostomidae*, and *Petromyzontidae*. Our sampling protocol was to collect 10-20 of each non–salmonid species at each site. Non–salmonid species were assigned a relative abundance ranking value based on general observations made during electrofishing (Table 1).

Relative abundance for non–salmonid species were treated semi–quantitatively. For each species in each site, a relative abundance was determined. The relative abundance was assigned a corresponding ranking value (Table 1). Ranked values were averaged, to determine a relative abundance for each species, per designated reach. Relative abundance data were tabulated to provide qualitative comparisons between reaches and species.

Table 1. Categories of relative abundance (per site) for non–salmonids.

Category	**Count** (individuals seen)	**Ranking Value** (for averaging sites)
Absent	0	0
Rare	1-3	1
Uncommon	4-10	2
Common	11-100	3
Abundant	100+	4

We also conducted "qualitative" electrofishing surveys in Dry creek and the Touchet River tributaries (Figure 4). These surveys enabled us to cover large areas relatively quickly as they did not entail the use of block nets or repeat passes with the electrofisher. We electrofished while moving upstream and capturing fish to determine species presence, size of fish (age class), and their relative abundance. We also noted the presence or general abundance of non–salmonids. This method supplemented our intensive "quantitative" electrofishing surveys, that provided density estimates, and our snorkel surveys, to provide a more complete view of salmonid distribution and abundance.

Snorkeling

Snorkeling sites were generally 90-120 meters in length. Snorkelers moved upstream, counting and identifying species, and estimating the age class of all salmonid fishes. Counts were recorded on PVC armbands. General abundance of non–salmonids were also noted. Snorkel surveys could be performed in deeper water, braided channels, and at other locations where electrofishing was not feasible. Another advantage of snorkeling was that we were able to cover a large amount of stream area in a short period of time and obtain density estimates. Snorkel surveys were conducted at selected sites both in the spring and summer for comparisons of salmonid distribution and densities temporally and by geographic location (Figure 3).

Observed salmonids were classified by age class based on their estimated size. Snorkelers reported genus classifications for all non–salmonid fish. Age class and relative abundance of non–salmonids were estimated and recorded. Site length and width measurements were taken to calculate the area surveyed. Brief habitat descriptions were recorded .

Spawning Surveys

Spawning surveys were conducted in the same manner for both steelhead and bull trout. Surveyors typically walked downstream and visually identified spawning fish and/or redds (nests). Redds were easily identified, characterized by an area of clean gravel with a large depression and mound. Each redd observed was assigned a two–part identification code representing the survey number and the redd number. A flag was hung in adjacent vegetation, and marked with the identification (ID) code, the date, and the surveyor's initials, so the same redd would not be counted in subsequent surveys. Each redd was recorded in a notebook with the date, time, ID code, general description of the redd and its location. Counts were tallied for each designated stream reach.

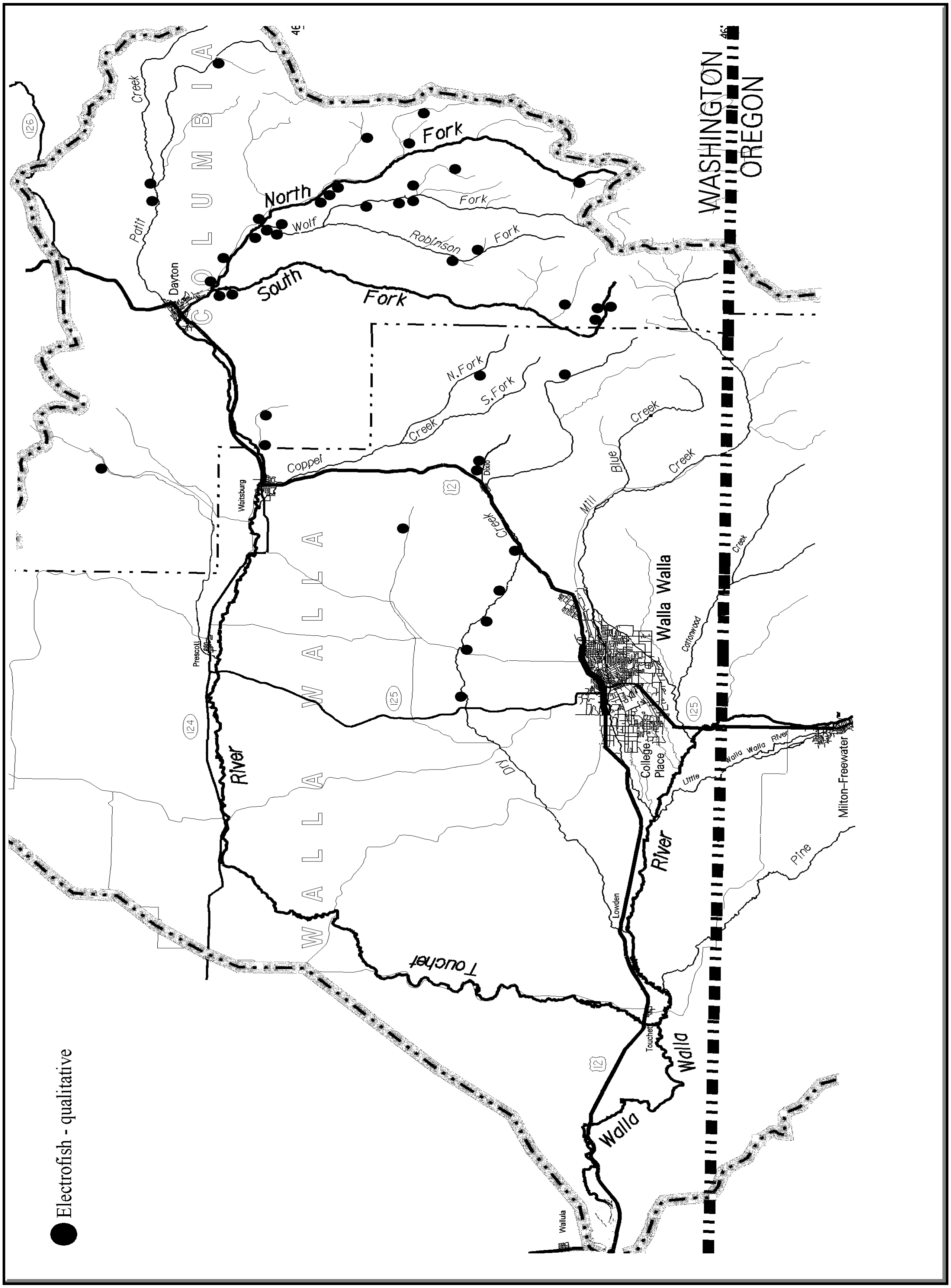


Figure 4. Relative locations of qualitative electrofishing sites in the Walla Walla Basin, 1999.

Genetic Sampling

Sampling of salmonid tissues was undertaken by WDFW, cooperating agencies, and volunteer personnel for genetic analyses. Fin clips were obtained from adult steelhead and bull trout collected at established fish traps on the Walla Walla River, Touchet River and Yellowhawk Creek. Fin clips provide sufficient DNA material for genetic analysis, without killing the fish (Olsen et al. 1996). A non–lethal method of genetic sampling was preferred due to the current ESA listings for bull trout and wild steelhead in the Walla Walla River basin.

Oregon Department of Fish and Wildlife personnel collected fin clips from steelhead and bull trout at the Nursery Bridge fish trap, located upstream of the Washington/Oregon border in Milton–Freewater. WDFW personnel collected fin clips from steelhead and bull trout at a trap at the Dayton Acclimation Pond intake dam on the Touchet River. In addition, 100 juvenile rainbow trout/steelhead were collected from each of the three major tributaries of the Touchet River (the North Fork, South Fork, and the Wolf Fork) for genetic analysis. The 300 juvenile fish collected from the Touchet River tributaries are for both DNA and allozyme analyses. Whole fish collections enables comparisons between current and past genetic analyses based on allozyme data, and may help integrate past data with current genetic techniques.

Fin clips were placed in tubes of ethanol for preservation, labeled and transported to the WDFW Genetics Stock Identification Lab in Olympia. Juvenile fish were placed in a dry ice cooler immediately after collection and transported to the ultra low freezer (-80°C) at Lyons Ferry Hatchery. They were later transported on dry ice to the Genetic Stock Identification Lab.

Results and Discussion

Habitat Assessment

Stream Flows

Stream flows in the Walla Walla River basin follow a fundamental pattern initiated by a rapid decline in discharge in late June, followed by low summer flows and increased discharge in the fall and winter. However, sites in proximity to major irrigation facilities exhibited more erratic stream flow patterns. Irrigation withdrawals included pumps, “push–up”dams for gravity diversions and irrigation district dams and canals. The reduced flows represent the end of the spring runoff, water diversions for agricultural irrigation, and the lack of summer precipitation in the basin. The recharge in the fall is generated because of fall precipitation and after most water diversions are discontinued or reduced.

Reduced flows downstream of major irrigation diversions operating in peak mode were observed during the field season (Appendix B). Specific observations included: (1) nearly complete dewatering of the Walla Walla River channel for about 2 miles below Nursery Bridge and some recharge just upstream of the Oregon State line; (2) sharp flow reductions below Burlingame Diversion in mid to late June and again in mid–October (as recorded by manual and instream flow monitors); and (3) a fairly steep decline in flows below Hofer Diversion in late June and early July (as recorded by manual and instream flow monitors).

The 1998-99 winter provided an exceptional snowpack in the Blue mountains, which generated good spring/summer flows in 1999. Spring/summer discharges for the Touchet River were consistently higher for the same sites in 1999 than in 1998 (Appendix B, and Mendel et al. 1999). However, the stream flows in the Washington portion of the Walla Walla River remained relatively consistent from year to year, because all of the water in the Walla Walla was diverted for irrigation upstream of the Oregon/Washington state line. During the diversion, stream flows in the Washington State portion of the Walla Walla River were comprised solely of tributary and groundwater recharge. The uppermost site in Washington, Pepper Br.(WW1), averaged slightly greater than 3.0 cfs during the diversion for both 1998 and 1999 (Appendix B). Water discharges for the Walla Walla River displayed a consistent flow pattern from one site to another (Figs. 5-9). Flow increases below the Burlingame diversion (WW5) was likely contributed by tributary (eg., Garrison and Mill Creeks, etc.) and groundwater recharge. The decrease in discharge evident in October in the Walla Walla River was caused by withdrawals of up to 100 cfs diverted at Burlingame Diversion.

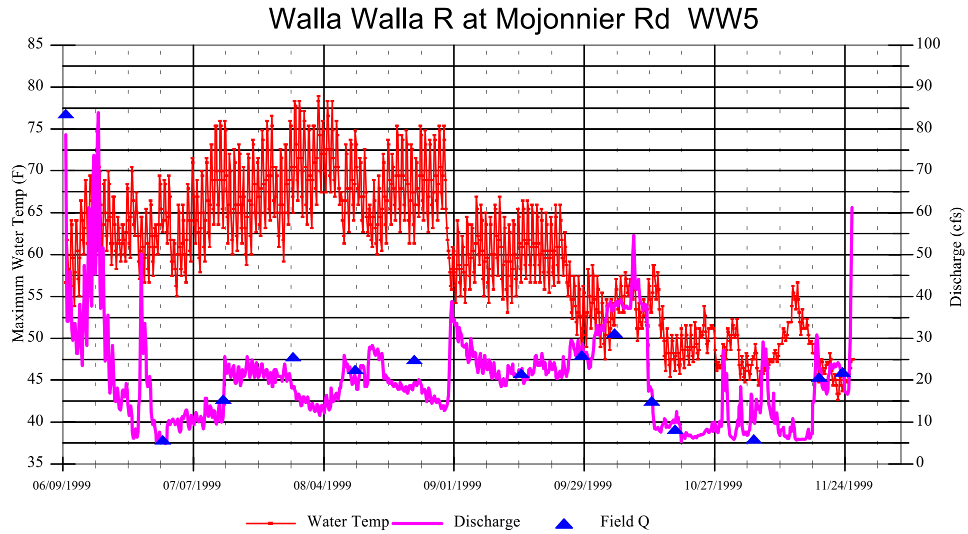


Figure 5. Stream discharge (CFS) and daily maximum water temperatures (°F) every four hours, below Mojonnier Bridge and Burlingame Dam, Walla Walla River, 1999. (Field Q = manual stream discharge measurement.)

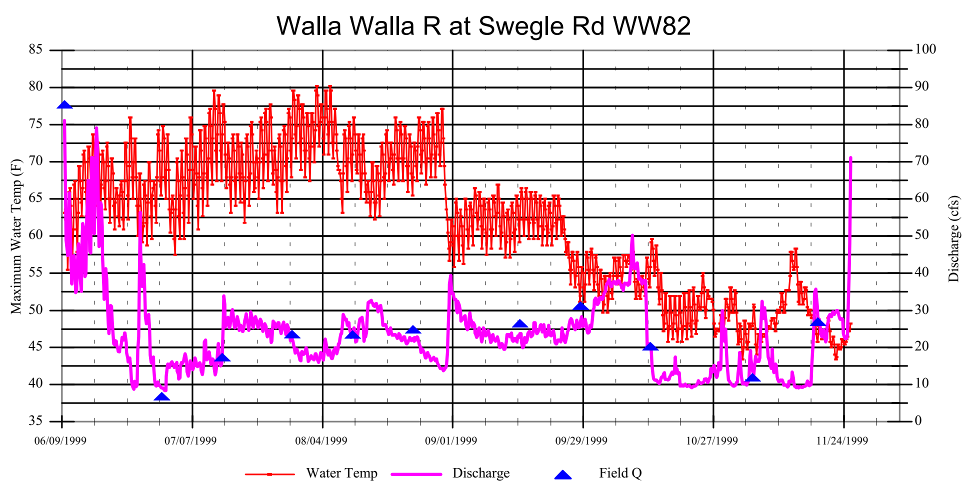


Figure 6. Stream discharge (CFS) and daily maximum water temperatures (°F) every four hours, below Swegle Bridge, Walla Walla River, 1999. (Field Q = manual stream discharge measurement.)

Walla Walla R at Detour Rd WW9

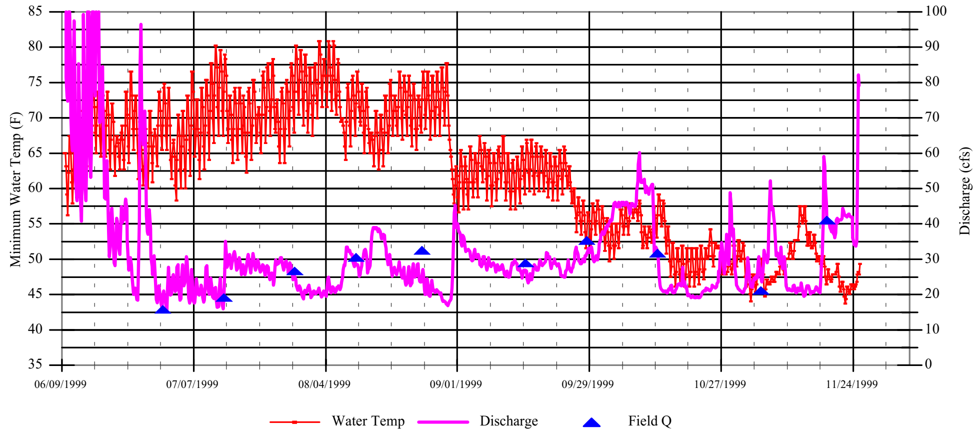


Figure 7. Stream discharge (CFS) and daily maximum water temperatures (°F) every four hours, above Detour Road, Walla Walla River, 1999. (Field Q = manual stream discharge measurement.)

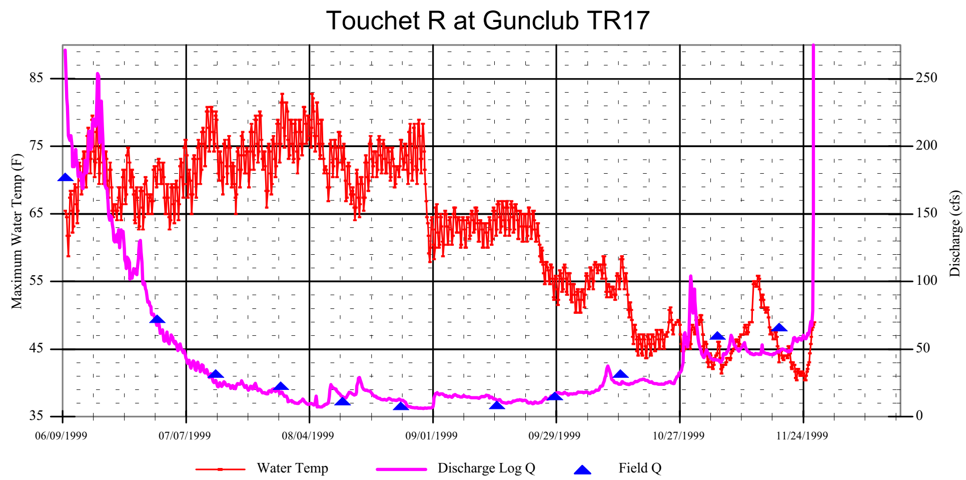


Figure 8. Stream discharge (CFS) and daily maximum water temperatures (°F) every four hours, below Touchet Gunclub, Touchet River, 1999. (Field Q = manual stream discharge measurement.)

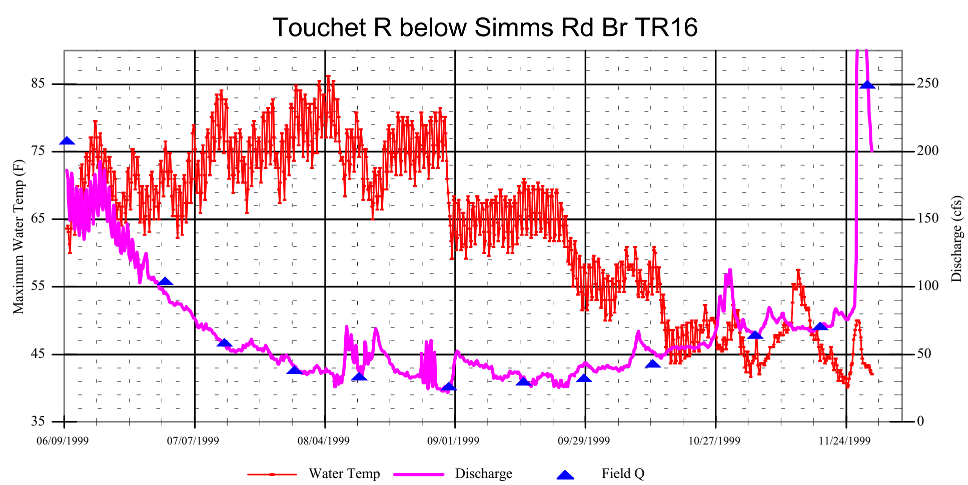


Figure 9. Stream discharge (CFS) and daily maximum water temperatures (°F) every four hours, below Simms Road Bridge, Touchet River, 1999. (Field Q = manual stream discharge measurement.)

Stream Temperatures

Stream temperature monitoring for the 1999 season was focused primarily in the mainstem Walla Walla River and the Touchet River and its tributaries (Appendix C). Water temperatures in 1999 were cooler throughout the Walla Walla basin than in1998. Sites where mean water temperatures were less than or equal to 60°F during summer months were generally located in tributaries associated with the Blue mountains; Spangler Ck (SC1), NF Touchet (NFT3), and Lewis Ck (LC6), Wolf Fork (WF1,WF3),Whitney Ck (WWC1), and Upper Robinson Fork (RF4). One exception is Whiskey Creek, a lower river tributary that empties into the Touchet River just upstream of the town of Waitsburg (TR10). Water temperatures from this tributary did not exceed 65°F, while maximum water temperatures in the Touchet River near Whiskey Creek routinely exceed 75°F. Stream temperatures reflect the region's hot and arid climatic regime and limited riparian vegetation. Peak daily temperatures at some instream monitoring sites routinely exceeded lethal temperatures for salmonids (75-84°F, Bjornn and Reiser 1991) during mid–summer (late June to early August), when the photo–period is long and evening cooling is brief. Sites with mean water temperatures greater than 70°F included the Washington state portion of the Walla Walla River (WW1, WW5, WW8, WW9, WW10), the Touchet River below Dayton (TR9, TR13, TR15, TR16, TR17), Dry Creek (DC3, DC10, DC13), Yellowhawk Creek(YC2), and the mainstem of Coppei Creek (MC1, MC3). Sites in the mid– and lower Touchet and Walla Walla frequently had daily maximum temperatures that were high enough (above 68°F) to inhibit migration of adults and young, and to sharply reduce survival of embryos and fry (Bjornn and Reiser 1991, Figure 6). Often maximum temperatures in these areas exceeded 75-85°F. However, at night, temperatures would usually decrease to within reasonable physiological limits for steelhead/rainbow trout (<65-70°F).

Water Quality

Preliminary water quality data was provided by WDOE for the Walla Walla River basin for May through September 1999. Preliminary assessments of noncompliance with State water quality standards were noted primarily for temperature, pH, and dissolved oxygen (Appendix D). The Walla Walla River downstream of the mouth of the Touchet River exceeded state standards six times; three for temperature and three for pH. All four sites in the basin exceeded both water temperature and pH standards during the month of August. Additional evaluation of the data and exceedence levels will be compiled by the WDOE in the future.

Limiting Factor Identification

A number of barriers or impediments to salmonid passage and rearing were identified during the 1999 field season. A portion of those barriers were physical (e.g., structures or dewatered streambeds) that physically blocked salmonid movement. We discovered several previously unknown barriers.

A migration barrier was identified 200 feet above the confluence of Lewis Creek and the North Fork Touchet River. The barrier, constructed of logs and rocks, was part of a private lake intake which did not have proper screening. Electrofishing data showed low densities of 0+ steelhead which provided supporting evidence that the barrier inhibited migration into Lewis Creek. A different barrier was identified in Whiskey Creek, but access to sample above the barrier was denied by the landowner. Qualitative electrofishing in lower Whiskey Creek produced high densities of age 0+ rainbow/steelhead. Similar investigations further upstream of the barrier yielded no salmonids. Whiskey Creek mean water temperatures remained below 60 ºF during the 1999 season, which likely provides refuge for salmonids from the Touchet River where mean water temperatures exceeded 70 ºF (Appendix C). A peculiar barrier was found on Mud Creek, a tributary of Dry Creek. Historically, a culvert was placed under a railroad grade, which apparently sank, creating a culvert which is positioned 30 degrees diagonally underground, with a 30-35–foot drop. Qualitative electrofishing yielded two age classes of juvenile rainbows/steelhead below the obstruction and no fish above it.

Several potential barriers were found. One was located on the upper North Fork Touchet at the Bluewood Road culvert. Quantitative electrofishing ½ mile above the culvert found no salmonids, but qualitative investigations just below the culvert showed good densities of bull trout. Qualitative electrofishing conducted above the culvert and upstream for approximately 150 feet yielded an age 0+ and an age 1+ bull trout, but very low densities of fish. In addition, a pair of bull trout were observed spawning 150 feet below the culvert. Another small barrier dam was reported for Patit Creek during March of 2000. The dam was visited by project staff in mid–March to determine the likelihood of fish passing this obstacle. At high and moderate flows it is likely a partial barrier, but at low flows it may be a complete barrier.

In 1999, WDFW assisted the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), in a salmonid rescue on the Walla Walla River below Nursery Bridge in Milton Freewater, Oregon. In July, all water from a section of the Walla Walla River just upstream of the Oregon border was diverted for irrigation. The area below the diversion was left nearly dry until the diversion ended in the fall. Salmonids in this segment of the river were collected by electrofishing and placed in a tanker truck for relocation. The Walla Walla fish rescue efforts collected three salmonid species; bull trout, rainbow/steelhead trout (wild), and whitefish. The salvage total was 6,619 wild salmonids, many of which were age 0+ steelhead or rainbow trout (Jon Germond, ODFW, pers communication, of 8-2-99). No similar rescue efforts occur in the partially dewatered sections of the Walla Walla River or Mill Creek within Washington.

Physiological barriers and impediments to salmonid passage and rearing were extensive in terms of stream miles affected. The primary physiological factor was temperature, although high pH and low dissolved oxygen levels were also documented in some mid– or lower mainstem river reaches. Temperature possibly represents the most critical physiological barrier to salmonids, particularly for passage or rearing. Temperature related barriers for salmonids generally occur in lower areas of the Touchet and Walla Walla Rivers and their tributaries. Stream reaches with mean water temperatures exceeding 75 °F during the summer are associated with very low densities of salmonids. Most of the salmonids in these marginal thermal areas are age 0+ rainbow/steelhead trout. A brief summary of some of the stream reaches with high temperatures was provided from data collected in 1998 (Mendel et al. 1999).

In 1999, salmonids were observed in areas of the stream where temperatures would have been lethal the previous year. For example, rainbow/steelhead were found a short distance below Waitsburg in 1999 (Bolles Bridge), but not in 1998. The cooler water temperatures in 1999 were related to the cooler weather pattern, not habitat improvement
.
Turbidity, sedimentation, lack of pools and cover, and other habitat factors, also present challenges to migrating, breeding and rearing salmonids. Extensive and intensive surveys of habitat conditions to identify limiting factors were deferred until 2000 because of lack of adequate staff time in 1999.

Fish Stock Assessment

Distribution and Abundance

Densities and biomass of five salmonid species were calculated from electrofishing and snorkeling surveys (Tables 2-6). Snorkeling provided densities only, and they are based on fish size (age) estimations by the surveyors. Adult rainbow densities represent wild or unknown origin trout unless noted. Salmonid species identified included: mountain whitefish (*Prosopium williamsoni*), brown trout (*Salmo trutta*), bull trout (*Salvelinus confluentus*), rainbow trout/steelhead (*Oncorhynchus mykiss*), and chinook salmon (*Oncorhynchus tshawytscha*).

Rainbow/steelhead trout represent the most common salmonid found in the Walla Walla Basin. Age 0+ rainbow/steelhead densities are typically higher than older age classes for most sites. Young–of–the–year trout (age 0+) were found downstream in the Touchet River as far as RM 39.4 (1 mile below Bolles Bridge - site TR14) in early summer, but only to Bolles Bridge during mid–summer. Age 0+ trout were found downstream to RM 27.4 on the Walla Walla River (above Lowden/Gardena Road, site WW11) during early July, but not during mid–August.

Table 2. Densities of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 1999. Sites are listed in order from upstream to downstream.

Stream Reach / Site Name	Site Length (m)	Mean Width (m)	Area (m^2)	Densities (#/100 m^2): Rainbow/steelhead Age/size 0+	1+	≥8 in	Total	Other Species[b]	Age/size 0+	1+	≥8 in
N. Fork Touchet											
NFT1	30.0	3.0	90.0	0	0	0	0.0				
NFT4	28.8	7.7	222.7	10.8	5.4	0	16.2				
NFT7	28.5	9.1	258.4	22.1	3.9[a]	0	26.0				
NFT12	47.0	10.5	491.9	36.6	12.6	3.3	52.5	BT	0.0	0.2	0.0
								BRT	0.0	0.6	0.4
								WF	0.0	0.0	0.2
NFT14	51.5	10.5	542.5	38.3	0.6	0	38.9				
Lewis Creek											
LC2	30.0	1.2	36.0	13.9	36.1	0	50.0				
LC3	30.0	2.6	78.6	2.5	19.1	0	21.6				
LC4	30.0	2.7	80.4	2.5	10.0	1.2	13.7				
LC5	45.9	1.9	88.1	0	7.9	0	7.9				
Jim Creek											
JC2	30.0	2.7	82.2	8.5	7.3	1.2	17.0				
JC3	30.0	2.5	76.0	3.9	6.6	0	10.5				
Wolf Fork											
WFT2	29.2	4.9	143.1	15.4	6.3	0	21.7	BT	7.7	2.8	0
WFT7	33.9	6.4	215.8	22.7[a]	9.3[a]	0	32.0	BT	0	1.4	0
WFT8	28.3	7.4	208.5	14.9	24.9	0.5	40.3	BT	0	0	0.5
								BRT	0.5	0.5	0
Coates Creek											
CC2	30.0	3.0	88.8	0	12.4	0	12.4				
CC3	30.0	2.6	77.4	3.9	11.6	0	15.5				
CC5	38.7	2.8	109.3	22.9	33.8	0	56.7				
CC6	42.0	3.5	148.8	14.1	23.5	0	37.7				
Robinson Fork											
RFT2	30.6	5.0	152.4	17.1	3.3	0.7	21.1	BT	0	0.7	0
RFT4	30.6	3.5	108.3	9.2	13.8	0	22.0				
RFT5	30.6	3.9	118.1	11.0	15.2	0	26.2				
RFT6	30.6	3.4	105.3	8.5	19	0	27.5				
RFT7	32.4	5.0	160.7	33.0	14.3	0	47.3				

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; WF = White Fish.

Table 2. Densities of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 1999 (continued). Sites are listed in order from upstream to downstream.

				Densities (#/100 m²)							
				Rainbow/steelhead							
Stream Reach	Site Length	Mean Width	Area	Age/size				Other	Age/size		
Site Name	(m)	(m)	(m²)	0+	1+	≥8 in	Total	Species[b]	0+	1+	≥8 in
Green Fork											
GF4	30.0	2.6	76.8	26.0	14.3	0	40.3				
GF5	30.0	2.5	73.5	53.1	34.0	0	87.1				
GF6	30.0	3.3	99.0	96.0	35.4	1.0	132.4				
Burnt Fork											
BF2	40.0	4.2	166.0	15.9	24.1	1.2	41.2				
BF3	30.0	3.7	111.0	3.6	31.5	0	35.1				
South Fork Touchet											
SFT1	30.0	4.4	132.0	12.9	9.1	0	22.0				
SFT2	39.0	7.6	295.1	3.4	10.5	0.3	14.2				
SFT3	36.5	10.6	385.7	7.8[a]	13.7	0.3	21.8				
SFT4	48.0	6.2	299.2	17.0	0.7	0	17.7				
SFT6	41.0	8.1	332.8	9.3	0.3	0.3	9.9				
South Fork Patit Creek											
SFP2	31.4	3.1	98.6	11.2	14.2	0	15.4				
SFP3	30.6	1.9	58.1	58.5	155.4	0	213.9				
SFP4	31.4	1.6	51.3	60.4	13.6	0	74.0				
Touchet River from Dayton to Waitsburg											
TR4	45.0	11.4	513.0	42.9	3.51[a]	0	47.4	BRT	0	0.2	0
TR5	149.0	23.5	3498.	5.3[a]	0.03	0	5.6	BRT	0.05	0	0
TR8	30.6	14.3	5	25.2[a]	0.2	0	25.4				
TR9	30.0	13.5	436.4	5.4[a]	0.2	0.7[a]	6.3		0.2		
TR10	41.2	15.6	403.8	17.2[a]	0	0	17.2	WF		0	0
TR12	31.0	16.2	643.5	7.0	0	0	7.0				
TR13	40.4	13.0	501.0	1.5	0	0	1.5				
			526.0								
South Fork Coppei Creek											
SFC1	38.8	3.4	130.0	15.4[a]	22.3	0	37.7				
SFC2	30.0	2.9	87.0	1.1	13.8	0	14.9				
SFC4	35.0	4.4	152.6	85.3[a]	14.4	0	99.7				
North Fork Coppei Creek											
NFC2	33.9	3.6	122.0	0	2.5	0	2.5				
NFC3	42.7	4.1	174.2	55.7[a]	10.3	0	66.0				
Coppei Creek											
C2	30.0	3.6	108.6	17.5	1.8	0	19.3				
C3	36.6	3.0	109.1	27.5[a]	0	0	27.5	BRT	1.0	0	0

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; WF = White Fish.

Table 3. Densities of salmonids from electrofishing sites in the Walla Walla River, and Dry Creek, summer and fall 1999. Sites are listed in order from upstream to downstream.

Stream Reach	Site Length	Mean Width	Area	Densities (#/100 m^2) Rainbow/steelhead Age/size			
Site Name	(m)	(m)	(m^2)	0+	1+	> 8 in	Total
North Fork Dry Creek							
NFD1	30.0	1.7	51.6	7.8	19.4	0	27.2
NFD2	30.0	3.3	97.8	11.2	4.1	0	15.3
Dry Creek							
DC1	30.0	4.5	135.0	13.3	9.6	0	22.9
DC2	30.6	3.9	118.4	18.6	20.3	1.7	40.6
DC3	30.6	4.0	123.0	65.0	5.7	0	70.7
DC4	30.0	2.8	84.6	26.0	2.4	0	30.4
DC5	30.4	2.9	89.1	1.1	13.5	0	14.6
DC11	30.0	2.8	83.4	1.2	0	0	1.2
Walla Walla River							
WW1	21.2	8.6	182.5	0.5	0	0	0.5
WW2	30.0	5.8	172.8	12.2	2.9	0	15.1
WW5	37.6	14.2	532.4	1.3	0	0	1.3
WW6	30.0	9.7	291.6	6.5[a]	0	0	6.5
WW8	30.7	7.9	241.3	0.8[a]	0.8[a]	0	1.6

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.

Table 4. Biomass of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 1999. Sites are listed in order from upstream to downstream.

Stream Reach	Site Length	Mean Width	Area	Biomass (g/100 m^2) Rainbow/steelhead Age/size				Other	Age/size		
Site Name	(m)	(m)	(m^2)	0+	1	> 8 in	Total	Species[b]	0	+1	+> 8 in
N. Fork Touchet											
NFT1	30.0	3.0	90.0	0	0	0	0.0				
NFT4	28.8	7.7	222.7	5.4	121.8[a]	0	127.2				
NFT7	28.5	9.1	258.4	39.7	104.9	0	144.6				
NFT12	47.0	10.5	491.9	204.9[a]	486.5[a]	598.1[a]	1289.5	BT	0	5.1	0
								BRT	0	8.9	93.2
								WF	0	0	37.7
NFT14	51.5	10.5	542.5	99.7	23.5	0	123.2				
Lewis Creek											
LC2	30.0	1.2	36.0	75.0	483.9	0	558.9				
LC3	30.0	2.6	78.6	16.3	530.5	0	546.8				
LC4	30.0	2.7	80.4	13.2	141.3	116.3	270.8				
LC5	45.9	1.9	88.1	0	186.7	0	186.7				

Table 4. Biomass of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 1999 (continued). Sites are listed in order from upstream to downstream.											
Stream	**Site**	**Mean**		**Biomass (g/100 m^2)**							
Reach	**Length**	**Width**	**Area**	**Rainbow/steelhead Age/size**				**Other**	**Age/size**		
Site Name	**(m)**	**(m)**	**(m^2)**	**0+**	**1**	**> 8 in**	**Total**	**Species**	**0**	**+1**	**+> 8 in**
Jim Creek											
JC2	30.0	2.7	82.2	24.7	278.1	150.1	452.9				
JC3	30.0	2.5	76.0	9.1	205.3	0	214.4				
Wolf Fork											
WFT2	29.2	4.9	143.1	7.7	200.7	0	208.4	BT	13.1	5.4	0
WFT7	33.9	6.4	215.8	31.8[a]	228.0[a]	0	259.8	BT	0	74.2	0
WFT8	28.3	7.4	208.5	23.8	541.3	51.3	616.4	BT	0	0	62.2
								BRT	2.3	27.5	0
Coates Creek											
CC2	30.0	3.0	88.8	0	406.3	0	406.3				
CC3	30.0	2.6	77.4	1.2	367.4	0	368.6				
CC5	38.7	2.8	109.3	16.0	649.8	0	665.8				
CC6	42.0	3.5	148.8	18.4	362.4[a]	0	380.8				
Robinson Fork											
RFT2	30.6	5.0	152.4	10.2	119.4	68.6	198.2	BT	0	103.6	0
RFT4	30.6	3.51	08.3	5.5	335.1	0	340.6				
RFT5	30.6	3.9	118.1	18.7	327.6	0	346.3				
RFT6	30.6	3.4	105.3	16.2	461.7	0	477.9				
RFT7	32.4	5.0	160.7	82.5[a]	463.7[a]	0	546.2				
Green Fork											
GF4	30.0	2.6	76.8	20.8	262.1	0	280.9				
GF5	30.0	2.5	73.5	58.4	537.4	0	595.8				
GF6	30.0	3.3	99.0	191.9	763.6	139.3	1094.8				
Burnt Fork											
BF2	40.0	4.2	166.0	12.7	894.0	131.6	1025.6				
BF3	30.0	3.7	111.0	5.0	627.5	0	632.5				
South Fork Touchet											
SFT1	30.0	4.4	132.0	33.5	240.9	0	274.4				
SFT2	39.0	7.6	295.1	5.82	26.9	44.3	277.0				
SFT3	36.5	10.6	385.7	15.6[a]	364.2	30.3	410.0				
SFT4	48.0	6.2	299.2	47.7	32.3	0	80.0				
SFT6	41.0	8.1	332.8	42.9[a]	6.3	39.2	88.4				
South Fork Patit Creek											
SFP2	31.4	3.1	98.6	13.4[a]	286.8[a]	0	300.2				
SFP3	30.6	1.9	58.1	81.9[a]	4298.6[a]	0	4380.5				
SFP4	31.4	1.6	51.3	181.3		0	583.8				

[a]. Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.

Table 4. Biomass of salmonids from electrofishing sites in the Touchet River and some of its tributaries, summer and fall 1999 (continued). Sites are listed in order from upstream to downstream.

Stream Reach / Site Name	Site Length (m)	Mean Width (m)	Area (m^2)	Biomass ($g/100\ m^2$) Rainbow/steelhead Age/size 0+	1	> 8 in	Total	Other Species	Age/size 0	+1	+> 8 in
Touchet River from Dayton to Waitsburg											
TR4	45.0	11.4	513.0	94.3	177.5[a]	133.4	405.2	BRT	0	30.4	0
DC5	149.0	23.5	3498.5	20.3[a]	2.8	0	23.1	BRT	0.7	0	0
DC6	30.6	14.3	436.4	148.7[a]	10.8	0	149.5				
DC7	30.0	13.5	403.8	19.1[a]	13.1	130.2[a]	162.4				
DC8	41.2	15.6	643.5	79.3[a]	0	0	79.3	WF	1.0	0	0
DC9	31.0	16.2	501.0	32.8	0	0	32.8				
DC15	40.4	13.0	526.0	9.9	0	0	9.9				
South Fork Coppei Creek											
SFC1	38.8	3.4	130.0	36.9[a]	553.3	0	590.2				
SFC2	30.0	2.9	87.0	4.3	339.3	0	343.6				
SFC4	35.0	4.4	152.6	161.9[a]	399.3	0	561.2				
North Fork Coppei Creek											
NFC2	33.9	3.6	122.0	0	58.0	0	58.0				
NFC3	42.7	4.1	174.2	116.9[a]	282.1	0	399.0				
Coppei Creek											
C2	30.0	3.6	108.6	75.2	59.3[a]	0	134.5				
C3	36.6	3.0	109.1	123.8[a]	0	0	123.8	BRT	4.0	0	0

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.
[b] BT = Bull Trout; BRT = Brown Trout; WF = White Fish.

Table 5. Biomass of salmonids from electrofishing sites in the Walla Walla River, and Dry Creek, summer and fall 1999. Sites are listed in order from upstream to downstream.

Stream Reach / Site Name	Site Length (m)	Mean Width (m)	Area (m^2)	Biomass ($g/100\ m^2$) Rainbow/steelhead Age/size 0+	1+	$\geq$ 8 in	Total
Dry Creek							
DC3	30.0	1.7	51.6	18.6	614.3	0	632.9
DC4	30.0	3.3	97.8	43.9	85.1	0	129.0
DC5	30.0	4.5	135.0	48.0	167.6	0	215.6
DC6	30.6	3.9	118.4	76.2	433.7	203.5	713.4
DC7	30.6	4.0	123.0	188.6	143.4	0	332.0
DC8	30.0	2.8	84.6	106.6	156.0	0	262.6
DC9	30.4	2.9	89.1	4.9	405.5	0	410.4
DC15	30.0	2.8	83.4	3.6	0	0	3.6

Table 5. Biomass of salmonids from electrofishing sites in the Walla Walla River, and Dry Creek, summer and fall 1999. Sites are listed in order from upstream to downstream.

				Biomass (g/100 m^2)			
				Rainbow/steelhead			
Stream Reach	Site Length	Mean Width	Area	Age/size			
Site Name	(m)	(m)	(m^2)	0+	1+	$\geq$ 8 in	Total
Walla Walla River							
WW1	21.2	8.6	182.5	4.2	0	0	4.2
WW2	30.0	5.8	172.8	31.6	148.6	0	175.4
WW5	37.6	14.2	532.4	6.0	0	0	6.0
WW6	30.0	9.7	291.6	37.1[a]	0	0	37.1
WW8	30.7	7.9	241.3	5.0[a]	45.4[a]	0	50.4

[a] Calculated using the sum of the passes due to poor reduction between successive passes, minimum estimates only.

Table 6. Densities of salmonids from snorkel surveys in the Touchet River and Walla Walla River, summer and fall 1999. Sites are listed in order from upstream to downstream.

Stream Reach Site Name	(date)	Site Length (m)	Mean Width (m)	Area (m^2)	Densities (#/100 m^2) Rainbow/steelhead Age/size 0+	1+	≥ 8 in	Total	Other Species [b]	Age/size 0+	1+	≥ 8 in
Touchet River												
TR1	(8/21)	113.0	9.7	1096.1	29.4	10.2	2.3[a]	41.5[a]				
TR6	(8/21)	105.0	9.8	1032.5	55.3	2.0	1.2[a]	58.5[a]	BRT	0	0	0.1
									SH	0	0	0.1
TR7	(8/20)	121.9	10.0	1219.0	12.5	0.3	0.1	12.9				
TR9	(6/24)	90.0	17.9	1612.8	7.1	1.0	0.8[a]	8.9[a]				
TR13	(8/20	90.0	17.7	1591.2	5.0	0.1	0.1[a]	5.2[a]				
TR14	(6/24)	90.0	13.4	1371.6	3.5	0	0.4[a]	3.7[a]				
	(8/20)	90.0	13.1	1371.6	0.5	0	0.2	0.7				
	(7/02)	90.0	15.2	1209.6	2.3	0.2	0	2.5				
	(8/20)	90.0	15.2	885.0	0	0	0	0				
Walla Walla River												
WW1[c]	(6/17)	100.0	15.6	1556.0	2.4	0.4	0.5	3.3	BT	0	0	0.1
									CK	0.1	0	0
WW3	(8/05)	183.0	7.8	1436.6	1.7	0	0.1[a]	1.8[a]				
WW4	(6/22)	130.0	14.4	1877.2	3.3	0.5	0	3.8				
	(8/05)	133.0	5.8	764.8	1.4	0	0	1.4	CK	0.1	0	0
WW5	(6/17)	100.0	13.4	1336.0	1.8	0.2	0.1	2.8				
	(8/20)	100.0	13.4	1336.0	2.8	0	0	2.8	WF	0.6	0	0
WW7	(8/19)	126.8	10.1	1283.9	4.7	0.8	0	5.5				
WW8	(6/22)	901.0	1.3	1020.6	25.8	3.9	1.7[a]	31.4[a]				
	(8/19)	901.0	1.3	1017.0	3.3	0.9	0.2[a]	4.4[a]				
WW9	(6/23)	120.0	9.6	1152.0	5.5	0.3	0.6	6.4				
	(8/12)	120.0	9.6	1152.0	0.9	0.1	0.0	1.0				
WW10	(6/23)	100.0	7.8	778.3	7.3	0.1	0.3[a]	7.7[a]				
	(8/12)	100.0	7.8	778.3	1.4	0.0	0.3[a]	1.7[a]				
WW11	(7/02)	43.4	4.5	196.2	101.0	0	0	101.0				
	(8/12)	43.4	4.5	196.2	0	0	0	0				

[a] Densities include hatchery trout.
[b] BT = Bull Trout; BRT = Brown Trout; WF = White Fish; CK = Chinook Salmon; SH = Adult Steelhead.
[c] Unable to conduct summer survey because of poor visibility.

Age 1+ rainbow/steelhead trout predominated in Lewis Creek[a], Coates Creek, Burnt Fork, and South Patit Creek. Large or "legal sized"(≥8 in.) rainbow trout were found in very low densities throughout the basin. The large numbers of age 0+ steelhead found in the Walla Walla River

[a]. A migration barrier was identified for Lewis Creek

was unexpected and it suggests that spawning is commonly occurring within the Washington portion of the river, at least during some years.

Other salmonid species had a limited distribution (Tables 2-6, Appendix E). In 1999, bull trout were found only on the North Fork, South Fork (personal communication Alan Childs, CTUIR), Robinson Fork, Lewis Creek, and Wolf Forks of the Touchet River. Bull trout distribution was generally isolated to the North Fork and the Wolf Fork of the Touchet River because only one bull trout was observed in each of the other tributaries listed above. Mountain whitefish were rare. They were found in low densities at only a few sites (WW5 in the Walla Walla River and sites NFT12, TR10 and WF8 in the Touchet River). Other sites did not contain whitefish. Brown trout were found in low densities (but included some very large individuals) in the mainstem Touchet River below Dayton and upstream into the major tributaries. Qualitative electrofishing produced five large adult brown trout (up to 4-6 lbs each), but very few juveniles were collected. Juvenile brown trout production appeared to be very limited in 1999. Two juvenile chinook salmon were observed in the Walla Walla River during snorkel surveys.

Electrofishing

Densities of rainbow/steelhead trout ranged from 0 to 1,289 fish per 100 m^2 at sampled sites (Tables 2 & 3). Sub–yearling (age 0+) fish were the most abundant age class at most sites. Densities and biomass of salmonids were reduced in the mainstem rivers compared to the tributaries, where water temperatures were lower (Tables 2-6). Biomass of salmonids ranged from 0 to 4,380 g/100m^2 (Tables 4 & 5). Rainbow/steelhead parr (age 1+) yielded the greatest biomass at most sites.

Snorkeling

Snorkel surveys were conducted at sites during different times in the summer to compare salmonid densities and distribution. A general decline in densities occurred between early and late summer. Subyearling rainbow/steelhead (age 0+) were the most abundant age class at all occupied sites (Table 6). One adult steelhead was observed in the Touchet River on August 21, just downstream from Dayton (site # TR6). One subadult bull trout was observed below Burlingame Dam in June.

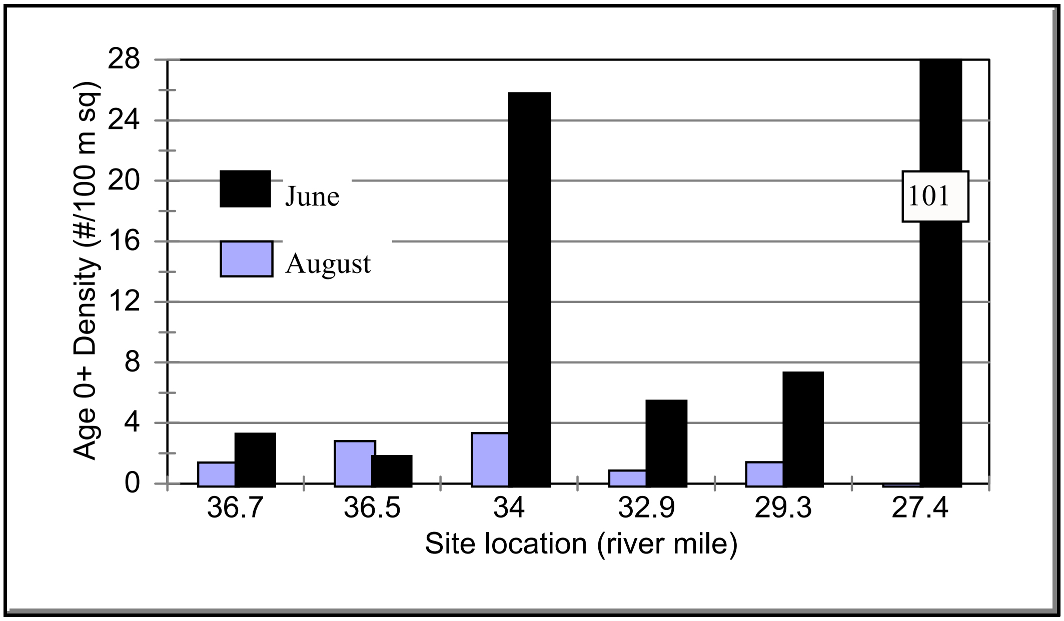


Figure 10. Comparison of age 0+ rainbow/steelhead densities observed during snorkeling in summer months between Burlingame Diversion (RM 36.7) and Lowden Gardena Bridge (RM 27.4) on the Walla Walla River, 1999.

Non–Salmonid Species Abundance and Distribution

Speckled dace and sculpins were the most common non–salmonids found at most of our sampling sites (Appendix F). Speckled dace generally did not exist at upper sites where water temperatures were relatively cool. Torrent sculpin distribution was limited to mid and lower river sites, and these fish were usually in low abundance. We observed large numbers bridge–lip suckers spawning in Coppei Creek, but later found very low densities of juvenile suckers during electrofishing surveys. Tailed frogs tadpoles were found only in upper sites in cold water, and appeared to be associated with bull trout distribution.

Spawning Surveys

Steelhead

Steelhead spawning surveys were conducted in Coppei Creek, Dry Creek, and Patit Creek in 1999 between April and late May (Table 7). There were no redds found in the Mainstem Patit Creek, additionally the embeddedness of the substrate was found to be unsuitable for redd construction. The mainstem Patit and sections of the lower S. Fork Patit dry up during summer and early fall, but the upper South Fork Patit Creek has perennial flows. Two steelhead redds were observed in the lower 2 miles of South Patit Creek. Resident rainbow were also observed spawning between RM 1.1 and 6.8 on the South Patit. The North Fork, South Fork and mainstem Coppei Creek produced a total count of 47 steelhead redds in the 14.2 stream miles surveyed (Table 7), averaging 3.3 redds per mile. During all steelhead spawning surveys, only one steelhead was observed on the South Fork Coppei. Six steelhead redds were observed in Dry Creek in 5.9 stream miles surveyed. The Dry Creek survey was conducted later in the spawning season and most of the stream reach was surveyed only once. Therefore, it should not be considered a complete estimate.

Table 7. Results of steelhead spawning surveys, 1999.

Reach/date	Survey	Stream section	Miles	Redds	Redds per mile
SF Patit Ck					
4/14	1	South fork confluence to river mile 1.1	1.1	1	0.91
4/16	1	River mile 1.1 to river mile 3.4	2.3	1	0.43
4/08	1	River mile 3.4 to river mile 6.8	2.4	0	0
4/26	2	South fork confluence to river mile 1.1	1.1	0	0
4/26	2	River mile 1.1 to river mile 3.4	2.3	0	0
4/26	2	River mile 3.4 to river mile 6.8	2.4	0	0
			5.8	**2.0**	**0.34**
Patit Ck					
3/31	1	River mile 3.7 to river mile 5.3	1.6	0	0
4/14	1	River mile 6.5 to river mile 7.4	0.9	0	0
4/27	2	River mile 3.7 to river mile 5.3	1.6	0	0
4/26	2	River mile 6.5 to river mile 7.4	0.9	0	0
			2.5	**0**	**0**
SF Coppei Ck					
4/07	1	South fork confluence to river mile 0.8	0.8	2	2.5
4/06	1	River mile 0.8 to river mile 2.0	1.2	0	0
4/06	1	River mile 2.0 to river mile 3.2	1.1	3	2.73
4/06	1	River mile 3.2 to river mile 4.3	1.1	0	0
4/01	1	River mile 4.3 to river mile 4.9	0.6	0	0
4/30	2	South fork confluence to river mile 0.8	0.8	6	7.5
4/30	2	River mile 0.8 to river mile 2.0	1.2	5	4.17
4/30	2	River mile 2.0 to river mile 3.2	1.1	4	3.64
4/30	2	River mile 3.2 to river mile 4.3	1.1	0	0
4/30	2	River mile 4.3 to river mile 4.9	0.6	0	0
			4.8	**20.0**	**4.17**
NF Coppei Ck					
4/06	1	North fork confluence to river mile 0.8	0.8	2	2.5
4/07	1	River mile 0.8 to river mile 1.4	0.6	6	10.0
4/08	1	River mile 1.4 to river mile 2.5	1.1	0	0
4/07	1	River mile 2.5 to river mile 4.0	1.5	0	0
4/29	2	North fork confluence to river mile 0.8	0.8	2	2.5
4/29	2	River mile 0.8 to river mile 1.4	0.6	1	1.67
4/29	2	River mile 1.4 to river mile 2.5	1.1	0	0
4/29	2	River mile 2.5 to river mile 4.0	1.5	0	0
			4.0	**11.0**	**2.75**

Table 7. Results of steelhead spawning surveys, 1999 (continued).

Reach/date	Survey	Stream section	Miles	Redds	Redds per mile
Coppei Ck					
4/13	1	River mile 1.8 to river mile 3.1	1.3	2	1.54
4/13	1	River mile 3.1 to river mile 4.6	1.5	4	2.67
4/01	1	River mile 4.6 to river mile 6.1	1.5	1	0.67
4/08	1	River mile 6.1 to river mile 7.2	1.1	6	5.45
4/27	2	River mile 1.8 to river mile 3.1	1.3	1	0.77
4/27	2	River mile 3.1 to river mile 4.6	1.5	1	0.67
4/27	2	River mile 4.6 to river mile 6.1	1.5	0	0
4/29	2	River mile 6.1 to river mile 7.2	1.1	0	0
			5.4	**16**	**2.96**
Dry Ck					
5/24	1	River mile 24.7 to river mile 26.1	1.4	0	0
5/24	1	River mile 26.1 to river mile 26.7	0.6	0	0
4/23	1	River mile 27.0 to river mile 27.6	0.6	0	0
4/23	1	River mile 27.6 to river mile 28.3	0.7	1	1.4
5/11	1	River mile 28.3 to river mile 29.6	1.3	1	0.77
5/11	1	River mile 29.6 to river mile 30.9	1.3	3	2.3
5/11	2	River mile 27.0 to river mile 27.6	0.6	1	1.67
5/11	2	River mile 27.6 to river mile 28.3	0.7	0	0
			5.9	**6**	**1.02**

Bull Trout

Bull trout spawning surveys were conducted on the upper Wolf Fork Touchet in 1998 and 1999 (Tables 8 and 9). Wolf Fork water temperatures during bull trout spawning season for both 1998-99 were in the low to mid 40s (°F). In 1999, bull trout initiated spawning at about 48°F.

Table 8. Bull trout spawning survey summary for the Wolf Fork of the Touchet River, 1999.

Reach/date	Survey	Stream section	Miles	Redds	Redds per mile
9/13	1	(A) River mile 11.3 to river mile 12.8	1.5	12.0	8.0
9/13	1	(B) River mile 10.3 to river mile 11.3	1.0	7.0	7.0
9/10	1	(C) River mile 9.6 to river mile 10.3	0.7	19.0	27.14
9/13	1	(D) River mile 8.7 to river mile 9.6	0.9	1.0	1.11
9/20	2	(A) River mile 11.3 to river mile 12.8	1.5	13.0	8.67
9/20	2	(B) River mile 10.3 to river mile 11.3	1.0	5.0	5.0
9/20	2	(C) River mile 9.6 to river mile 10.3	0.7	9.0	12.86
9/20	2	(D) River mile 8.7 to river mile 9.6	0.9	6.0	6.67
9/20	2	(E) River mile 7.3 to river mile 8.7	1.4	0	0
9/27	3	(A) River mile 11.3 to river mile 12.8	1.5	7.0	4.67
9/27	3	(B) River mile 10.3 to river mile 11.3	1.0	2.0	2.0
9/27	3	(C) River mile 9.6 to river mile 10.3	0.7	4.0	5.71
9/27	3	(D) River mile 8.7 to river mile 9.6	0.9	2.0	2.22
9/27	3	(E) River mile 7.3 to river mile 8.7	1.4	2.0	1.43
10/11	4	(A) River mile 11.3 to river mile 12.8	1.5	0.0	0
10/11	4	(B) River mile 10.3 to river mile 11.3	1.0	0.0	0
10/11	4	(C) River mile 9.6 to river mile 10.3	0.7	2	2.86
10/11	4	(D) River mile 8.7 to river mile 9.6	0.9	1.0	1.11
10/11	4	(E) River mile 7.3 to river mile 8.7	1.4	0.0	0
10/25	5	(B) River mile 10.3 to river mile 11.3	1.0	0.0	0
10/25	5	(C) River mile 9.6 to river mile 10.3	0.7	0.0	0
10/25	5	(D) River mile 8.7 to river mile 9.6	0.9	1.0	1.11
10/25	5	(E) River mile 7.3 to river mile 8.7	1.4	0.0	0
			5.5	**93.0**	**16.91**

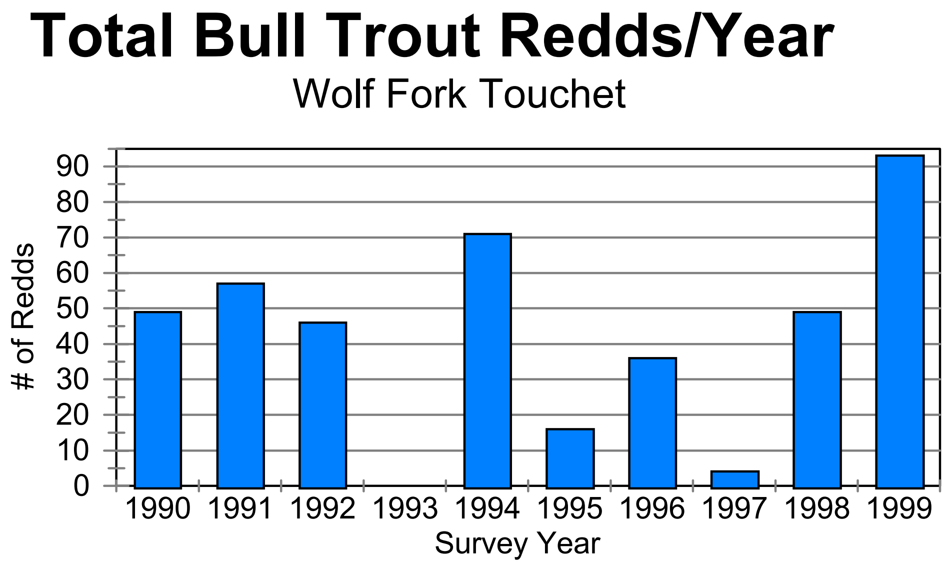
Table 9. Bull trout spawning survey summary for the Wolf Fork of the Touchet River, 1998.

Date	Survey	Stream section	Miles	Redds	Redds per mile
9/28	1	(A) River mile 11.3 to river mile 12.8	1.5	7	4.67
9/24	1	(B) River mile 10.3 to river mile 11.3	1.0	3	3.0
9/24	1	(C) River mile 9.6 to river mile 10.3	0.7	9	12.86
9/24	1	(D) River mile 8.7 to river mile 9.6	0.9	9	10.0
9/28	1	(E) River mile 7.3 to river mile 8.7	1.4	0	0
10/08	2	(A) River mile 11.3 to river mile 12.8	1.5	4	2.67
10/08	2	(B) River mile 10.3 to river mile 11.3	1.0	2	2.0
10/08	2	(C) River mile 9.6 to river mile 10.3	0.7	6	8.57
10/14	2	(D) River mile 8.7 to river mile 9.6	0.9	4	4.4
10/14	2	(E) River mile 7.3 to river mile 8.7	1.4	0	0
10/21	3	(A) River mile 11.3 to river mile 12.8	1.5	0	0
10/21	3	(B) River mile 10.3 to river mile 11.3	1.0	2	2.0
10/21	3	(C) River mile 9.6 to river mile 10.3	0.7	3	4.29
10/21	3	(D) River mile 8.7 to river mile 9.6	0.9	0	0
10/21	3	(E) River mile 7.3 to river mile 8.7	1.4	0	0
			5.5	**49**	**8.9**

In 1999, the Wolf Fork was surveyed from its headwaters downstream to determine bull trout spawning distribution. Spawning distribution in 1999 coincidentally matched the same area surveyed in 1998. In 1999, five surveys were conducted between September 10 and October 25. A total of 93 redds were identified and 89 of these were documented in September. Over 30 redds were observed in the upper survey sections A and C (Table 9). Two redds were found in section E, which we believe are the lowest documented bull trout redd for the Wolf Fork. Redd counts in the Wolf Fork were nearly double those of 1998, similar to other streams in the Blue Mountains in 1999 (Pers. Communication Mike Northrup, USFS).

In 1998, three surveys were conducted between September 24 and October 21. A total 49 redds were recorded and 21 of those were recorded in October (Table 9). The uppermost documented redd identified in 1998 was near RM 12.8 (section A).

Survey locations and dates have not been consistent for the Wolf Fork during the ten–year period of bull trout spawning surveys (Figure 11). The upper portion within the USFS boundaries was not surveyed prior to 1998. The single survey conducted in 1997 was in late October and was too far downstream. Therefore, it should not be compared to the surveys that were done between 1994 to 1996.



Year	Reach Surveyed [a] A River Mile 12.8 - 11.3	B River Mile 11.3 - 10.3	C River Mile 10.3 - 9.6	D River Mile 9.6 - 8.7	E River Mile 8.7 - 7.3	F River Mile 7.3 - 6.8	Total Redds
1990		18	31				49
1991		20	37				57
1993[b]							0
1994		71					71
1995		16					16
1996		36					36
1997[c]				4			4
1998	11	7	18	12	0		48
1999	32	14	34	11	2		93

a. A: RM 11.3 = USFS boundary, B: RM 10.3 = Tate Cr., C: RM 9.6 = Newby's ford, D: RM 8.7 = second bridge down, E: RM 7.3 = Whitney Cr., F: RM 6.8 = County bridge.

b. No survey.

c. One survey done late in October and too far down stream.

Figure 11. Bull trout spawning survey summary for the Wolf Fork of the Touchet River, 1990-99.

Genetic Sampling

Fin clips were collected from a total of 32 adult bull trout during the 1999 season; 2 were collected from the trap at Nursery Bridge in Oregon, and 16 from the trap on the Touchet River in Dayton, Washington. These samples were sent to the WDFW Genetics Stock Identification Lab for DNA analysis. Additionally, 14 samples; 9 from the North Fork Touchet, 4 from the

Wolf Fork Touchet, and 1 from Lewis Creek, were collected during electrofishing and hook and line sampling. These 14 samples have not been sent to the Genetics Lab at this time. No samples were collected from Mill Creek in 1999 by WDFW. Staff of the Umatilla Tribe (CTUIR) did collect 100 juvenile fish for genetic samples from Mill Creek in 1999 (Craig Contor, CTUIR, personal communication).

Fin clip tissue samples were collected from 83 adult steelhead during the 1999 season; 50 from the trap at Nursery Bridge and 33 from the trap on the Touchet River. All adult steelhead DNA samples were sent to the Genetics Lab.

Allozyme and DNA samples were collected by electrofishing juvenile rainbow/steelhead trout during the summer and fall of 1999; 100 from several sites on the North Fork Touchet, 100 from the Wolf Fork Touchet, and 95 from the South Fork Touchet. Fish were collected only if they were approximately age 1+ or older ($\geq$ 80 mm). We collected no more than 10 fish from each site to minimize the chances of collecting siblings. Entire fish were killed and frozen on dry ice for allozyme analysis, which will be used for comparison with past allozyme data, and to help integrate the data with current DNA genetic analysis.

Additionally, 52 other juvenile rainbow/steelhead trout fin tissue samples were collected; 31 on the North Fork Touchet, 13 on the Wolf Fork Touchet, and 8 on the South Fork Touchet, during electrofishing and hook and line sampling. The DNA samples have not been sent to the Genetics Lab at this time.

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Appendix A. Study Sites, 1999

Appendix A. Table 1. Touchet River and tributary study sites, 1999.

Reach	Site #	RM[d]	Location	Sample Type[a]	Comments
NF Touchet River	NFT-1	18.5	T7N,R40E,Sect 7,SE¼,SW¼	EQ,F	100 yds above Bluewood Rd
	NFT-2	18.3	T7N,R40E,Sect 7,SE¼,SE¼	EL	Bluewood Rd
	NFT-3	13.9	T8N,R40E,Sect 28,NE¼,NE¼	T,F[b],W	Mouth of Spangler Ck
	NFT-4	10.6	T8N,R40E,Sect 8,NE¼,NE¼	EQ [c]	7.1 mi above Wolf Fk. Br.
	NFT-5	7.3	T9N,R40E,Sect 30,NE¼,SW¼	EL,T,F	75 ft. above Jim Creek
	NFT-6	6.7	T9N,R40E,Sect 9,SW¼,SW¼	EL	0.5 mi. below Jim Ck
	NFT-7	5.8	T9N,R39E,Sect 24,NE¼,NW¼	EQ [c]	1.7 mi up Wolf Fk Br.
	NFT-8	5.7	T9N,R39E,Sect 24,NE¼,NW¼	EL	1.6 mi up Wolf Fk Br.
	NFT-9	4.1	T9N,R39E,Sect 11,SE¼,NE¼	EL	Wolf Fork Rd turnoff
	NFT-10	3.1	T9N,R39E,Sect 3,SE¼,SE¼	EL	Orchard
	NFT-11	2.0	T9N,R39E,Sect 3,NW¼,SE¼	EL	2 mi above Baileysburg
	NFT-12	1.6	T9N,R39E,Sect 3,NW¼,NW¼	EQ,T	1.4 mi above Baileysburg
	NFT-13	1.3	T9N,R39E,Sect 4, NE¼,NW¼	EL	Baileysburg
	NFT-14	0.3	T10N,R39E,Sect 32,SE¼,NW¼	EQ [c]	0.1 mi below SF Rd. Br.
Spangler Creek	SC-1	0.2	T8N,R40E,Sect 27,NW¼,NW¼	T,W,F	FS Jeep trail
Lewis Ck & Ireland Gulch	LC-1	2.8	T8N,R40E,Sect 11,SW¼,NW¼	EL	Top/Headwaters
	LC-2	2.1	T8N,R40E,Sect 10,NE¼,NE¼	EQ	Upper Lewis
	LC-3	1.1	T8N,R40E,Sect 3,SW¼,NW¼	EQ	Forest Service line
	LC-4	0.9	T8N,R40E,Sect 4,SE¼,SE¼	EQ,W	Lewis Creek Cabins
	LC-5	0.8	T8N,R40E,Sect 9,NE¼,NE¼	EQ,EL	Ireland Gulch
	LC-6	0.2	T8N,R40E,Sect 9,NW¼,NW¼	T,W,F	Lowest site
Jim Creek	JC-1	3.1	T9N,R40E,Sect 34,NW¼,SE¼	EL	USFS line
	JC-2	0.5	T9N,R40E,Sect 29,NW¼,SE¼	EQ,W,T,F	0.5 mi up Jim Ck Rd
	JC-3	0.1	T9N,R40E,Sect 30,NE¼,SE¼	EQ	Below culvert N.Touchet Rd
Wolf Fork	WF-1	10.0	T8N,R39E,Sect 25,NE¼,SW¼	T,F,W	Below Green Fly Canyon
	WF-2	9.0	T8N,R39E,Sect 24,NE¼,SW¼	EQ [c]	6.3 mi above Robinson Fk.
	WF-3	6.8	T8N,R40E,Sect 7,NW¼,NW¼	EL	1ST Br. below yellow gate
	WF-4	6.3	T8N,R39E,Sect 1,SE¼,NE¼	EL	0.9 mi below Coates Ck
	WF-5	4.5	T9N,R39E,Sect 36,SE¼,NW¼	EL	1.5 mi above Robinson Fk
	WF-6	4.0	T9N,R39E,Sect 25,SE¼,NW¼	T	2nd Bridge
	WF-7	2.9	T9N,R39E,Sect 23,SE¼,SW¼	EQ [c]	0.1mi below Robinson Fk Br
	WF-8	1.7	T9N,R39E,Sect 14,SW¼,SE¼	EQ [c]	1.3 mi up Wolf Fk Rd Br
	WF-9	1.6	T9N,R39E,Sect 23,NW¼,NW¼	T,W,F	Holmberg Rd Br
	WF-10	0.7	T9N,R39E,Sect 14,NW¼,NE¼	EL	0.5 mi up Wolf Fork Rd
	WF-11	0.5	T9N,R39E,Sect 11 SE¼,SW¼	EL	0.3 mi up Wolf Fork Rd

[a] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[b] Index discharge sites.
[c] Sites electrofished by Snake River Lab. personnel.
[d] River mile.

Appendix A. Table 1. Touchet River and tributary study sites, 1999 (continued).

Reach	Site #	RM[d]	Location	Sample Type[a]	Comments
Coates Creek	C-1	2.2	T8N,R40E,Sect 17,SW¼,SE¼	EL	Top Site
	C-2	1.6	T8N,R40E,Sect 17,NW¼,SE¼	EQ	0.5 mi from top site
	C-3	0.9	T8N,R40E,Sect 18,NE¼,NE¼	EQ	1.3 mi from top site
	C-4	0.7	T8N,R40E,Sect 7,SE¼,SE¼	EL	0.6 mi above Wolf Fork Rd.
	C-5	0.7	T8N,R40E,Sect 7,SE¼,SE¼	EQ	0.6 mi above Wolf Fork Rd.
	C-6	0.1	T8N,R40E,Sect 7,SW¼,NE¼	EQ,W,F	0.1 mi above Wolf Fork Rd.
Whitney Creek	WH-1	0.3	T8N,R40E,Sect 18,NW¼,NE¼	T,W,F	0.2 mi above Wolf Fk Rd.
Robinson Fork	RF-1	7.4	T8N,R39E,Sect 27,SE¼,NW¼	EL	0.45 mi above dry tributary
	RF-2	7.3	T8N,R39E,Sect 27,NE¼,NE¼	EQ	7.3 mi up Robinson Fk Rd
	RF-3	6.7	T8N,R39E,Sect 27,NW¼,NE¼	EL	6.7 mi up Robinson Fk Rd
	RF-4	6.3	T8N,R39E,Sect 22,NW¼,NW¼	EQ,T,W,F	6.3 mi up Robinson Fk Rd
	RF-5	5.2	T8N,R39E,Sect 15,SW¼,NE¼	EQ	5.2 mi up Robinson Fk Rd
	RF-6	4.2	T8N,R39E,Sect 10,SE¼,NE¼	EQ	4.2 mi up Robinson Fk Rd
	RF-7	2.3	T8N,R39E,Sect 2,NW¼,NE¼	EQ	Above 1st Br on jeep trail
	RF-8	1.5	T9N,R39E,Sect 35,NE¼,SW¼	T,W,F	Below 1st Br on jeep trail
SF Touchet River	SFT-1	14.5	T7N,R39E,Sect 6,SW¼,NE¼	EQ	Below Burnt Fork at ford
	SFT-2	11.5	T8N,R39E,Sect 20,NW¼,NW¼	EQ [c]	3.1mi above Nancy Lee Br.
	SFT-3	8.0	T8N,R39E,Sect 5,SE¼,SE¼	EQ [c]	0.2 mi below Nancy Lee Br.
	SFT-4	2.3	T9N,R39E,Sect 9,SW¼,NW¼	EQ [c]	Pettyjohn Rd. Br
	SFT-5	1.1	T9N,R39E,Sect 5,SE¼,NW¼	EL	Harting grade Br
	SFT-6	0.5	T9N,R39E,Sect 5,NE¼,NW¼	EQ	0.4 mi up SF Touchet Rd
	SFT-7	0.2	T10N,R39E,Sect 32,SE¼,SW¼	EL,T,F[b],W	Gephart Rd
Green Fork	GF-1	3.2	T7N,R39E,Sect 19,NE¼,SW¼	EL,F	Rt Fork upper Green
	GF-2	3.2	T7N,R39E,Sect 19,NE¼,SW¼	EL	Left Fork upper Green
	GF-3	3.0	T7N,R39E,Sect 19,NW¼,SE¼	EL,F	Wooden Br.
	GF-4	2.6	T7N,R39E,Sect 19,NW¼,NW¼	EQ	Uppermost Site
	GF-5	1.5	T7N,R39E,Sect 13,NE¼,SW¼	EQ,F	Site 1A
	GF-6	0.8	T7N,R39E,Sect 12,SE¼,SE¼	EQ,W	Site B
Burnt Fork	BF-1	2.1	T7N,R39E,Sect 17,NE¼,NE¼	EL	Uppermost Site
	BF-2	0.7	T7N,R39E,Sect 7,SE¼,NW¼	EQ	0.7 mi up Burnt Fk
	BF-3	0.2	T7N,R39E,Sect 7,NW¼,NE¼	EQ,F	0.5 mi down from BF-2
Patit Creek	PC-1	6.5	T10N,R40E,Sect 24,NE¼,SW¼	EL	Lower barn
	PC-2	5.4	T10N,R39E,Sect 23,NE¼,NW¼	T,F[b]	Range Grade Br.
SF Patit Creek	SFP-1	8.0	T10N,R40E,Sect 31,SW¼,NE¼	EL	Upper Forks
	SFP-2	6.7	T10N,R40E,Sect 25,SE¼,SE¼	EQ,T,W,F	200 ft above end of Rd.
	SFP-3	4.4	T10N,R40E,Sect 23,SE¼,SW¼	EQ,W	4.8 mi up S. Patit Rd
	SFP-4	3.5	T10N,R40E,Sect 22,SE¼,SW¼	EQ	Blue Gate
	SFP-5	0.0	T10N,R39E,Sect 19,NW¼,NE¼	EL	Mouth of S. Patit Ck
NF Patit Creek	NFP-1	0.6	T10N,R40E,Sect 14,SW¼,SE¼	T	North Fork

[a] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[b] Index discharge sites.
[c] Sites electrofished by Snake River Lab. personnel.
[d] River mile.

Appendix A. Table 1. Touchet River and tributary study sites, 1999 (continued).

Reach	Site #	RM[d]	Location	Sample Type[a]	Comments
Touchet River	TR-1	54.0	T10N,R39E,Sect 30,SE¼,SE¼	S	Above intake
	TR-2	53.8	T10N,R39E,Sect 30,SE¼,SE¼	T	Snake River Lab
	TR-3	53.5	T10N,R39E,Sect 30,SE¼,NW¼	F[b]	Flag pole
	TR-4	53.3	T10N,R39E,Sect 35,NW¼,SE¼	EQ	Hwy 12 Br., Dayton
	TR-5	51.6	T10N,R38E,Sect 36,NW¼,SW¼	EQ	Trailer Park
	TR-6	51.2	T9N,R38E,Sect 35,SE¼,NE¼	S	Poor Farm Rd
	TR-7	50.3	T10N,R38E,Sect 35,SW¼,SW¼	S	Back from grain elevators
Touchet River	TR-8	49.7	T9N,R38E,Sect 3,NW¼,SE¼	EQ	Rose Gulch Br
	TR-9	48.4	T9N,R38E,Sect 4,NW¼,SW¼	EQ,S,T	L & C State Park
	TR-10	46.4	T9N,R38E,Sect 7,NW¼,SW¼	EQ	Hogeye Hollow Rd.
	TR-11	45.1	T9N,R37E,Sect 12,SW¼,SW¼	EQ,W	1 mi above County Park
	TR-12	44.1	T9N,R37E,Sect 11,SW¼,NE¼	EQ	Waitsburg County Park
	TR-13	40.5	T9N,R37E,Sect 8,NW¼,SW¼	S,T,F[b],W	Bolles Br.
	TR-14	39.4	T9N,R36E,Sect 12,NE¼,NE¼	S	1 mi. below Bolles Br.
	TR-15	27.4	T9N,R35E,Sect 5,NW¼,SW¼	T	Lamar Rd
	TR-16	11.3	T8N,R33E,Sect 23,SW¼,NE¼	T,F[b],G,W	Below Simms Rd. Br.
	TR-17	2.8	T7N,R33E,Sect 22,SE¼,NW¼	T,F[b],G,W	0.3 mi above Markham Rd
Whiskey Creek	WC-1	2.7	T9N,R38E,Sect 17,SE¼,NW¼	T,EL	1st Br on Whiskey Ck Rd
	WC-2	0.1	T9N,R38E,Sect 7,SW¼, NW¼	EL	Mouth of Whiskey Ck
South Fork Coppei	SFC-1	4.6	T8N,R38E,Sect 33,NW¼,NE¼	EQ	Below Barnes Rd./Ck
	SFC-2	3.5	T8N,R38E,Sect 22,NE¼,NE¼	EQ	Geir Road
	SFC-3	3.2	T8N,R38E,Sect 20,SE¼,SE¼	T,F[b]	Canyon Culvert
	SFC-4	0.8	T8N,R38E,Sect 18,NW¼,NE¼	EQ,W	Walker Rd Bridge
North Fork Coppei	NFC-1	4.6	T8N,R38E,Sect 27,NE¼,NW¼	EL	Above DNR gate
	NFC-2	4.0	T8N,R38E,Sect 22,SW¼,NE¼	EQ	DNR gate
	NFC-3	1.4	T8N,R38E,Sect 8,SW¼,NW¼	EQ	1.3 mi up NF Coppei Rd
	NFC-4	0.8	T8N,R38E,Sect 8,SW¼,NW¼	T,F[b],W	Grain Elevators
Mainstem Coppei	MC-1	4.6	T9N,R37E,Sect 25,SW¼,SE¼	T	Above McCowen Rd. Br
	MC-2	3.4	T9N,R37E,Sect 23,SW¼,SW¼	EQ	Old Airstrip
	MC-3	1.8	T9N,R37E,Sect 14,NW¼,SE¼	EQ,T,F[b]	Below Meinberg Rd. Br.

[a] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[b] Index discharge sites.
[c] Sites electrofished by Snake River Lab. personnel.
[d] River mile.

Appendix A. Table 2. Walla Walla River and tributary study sites, 1999.

Reach	Site #	RM[d]	Location	Sample Type[a]	Comments
Whetstone	W-1	13.3	T10N,R37E,Sect 11,SE¼,NW¼	EL,W	McKay Creek
	W-2	8.4	T10N,R37E,Sect 33,NE¼,SW¼	EQ,W	Weller Canyon Rd Bridge
Spring Creek	SC-1	15.8	T8N,R37E,Sect 10,SW,NW	EL	Stonecipher Rd
Dry Creek	DC-1	32.3	T7N,R38E,Sect 7,SW¼,SW¼	EQ,W	1 mi above Dry Ck Rd Br
	DC-2	31.2	T7N,R38E,Sect 18,NW¼,NW¼	EQ,W	Dry Creek Rd Bridge
	DC-3	27.3	T8N,R37E,Sect 35,NE¼,NW¼	EQ,T,F[b],W	0.5 mi up Biscuit Ridge Rd
	DC-4	25.6	T8N,R37E,Sect 34,NW¼,NW¼	EQ	0.4 mi below Dixie
	DC-5	24.6	T8N,R37E,Sect 33,SW¼,SW¼	EQ	1.4 mi below Dixie
	DC-6	23.4	T7N,R37E,Sect 5,NW¼,NW¼	EL	Smith Rd Bridge
	DC-7	21.0	T8N,R36E,Sect 36,NW¼,SW¼	EL	Below Mid Waitsburg Rd
	DC-8	19.7	T8N,R36E,Sect 26,SW¼,SW¼	EL	Middle Waitsburg Rd Br
	DC-9	17.6	T8N,R36E,Sect 21,SE¼,SW¼	EL	Above Mid Waitsburg Rd
	DC-10	17.4	T7N,R36E,Sect 21,SW¼,NE¼	T	Low Waitsburg Rd. Bridge
	DC-11	15.0	T8N,R36E,Sect 19,SW¼,SE¼	EQ	Valley Grove
	DC-12	14.5	T8N,R36E,Sect 30,NW¼,NW¼	EL	0.25 mi below Valley Grove
	DC-13	3.4	T7N,R34E,Sect 22,SE¼,NE¼	T	Talbott Rd Bridge
N Fork Dry Crk	NFD-1	2.4	T7N,R38E,Sect 10,SW¼,NW¼	EL	Top site
	NFD-2	1.4	T7N,R38E,Sect 9,NE¼,NW¼	EQ,W	1.4 mi up Scott Rd
	NFD-3	0.6	T7N,R38E,Sect 9,NW¼,SW¼	EQ	0.6 mi up Scott Rd
	NFD-4	0.4	T7N,R38E,Sect 8,NE¼,SE¼	T,F	0.4 mi up Scott Rd
Walla Walla R	WW-1	39.6	T6N,R35E,Sect 13,NW¼,NW¼	EQ,S,W,T,F[b]	Pepper Bridge Rd Br
	WW-2	38.2	T6E,R35E,Sect 11,NW¼,NE¼	EQ,W	Old Milton-Freewater Brg
	WW-3	37.2	T6E,R35E,Sect 3,SE¼,SW¼	S	0.5 mi above Burlingame
	WW-4	36.7	T6E,R35E,Sect 3,SW¼,SW¼	S	Burlingame Diversion
	WW-5	36.5	T6E,R35E,Sect 3,SW¼,NW¼	EQ,S,F[b],W,G	Mojonnier Rd.
	WW-6	35.4	T6E,R35E,Sect 4,NW¼,SW¼	Q,W	Above Last Chance Rd Br
	WW-7	35.2	T6E,R35E,Sect 5,NE¼,NE¼	S	Below Last Chance Rd Br
	WW-8	34.0	T7E,R35E,Sect 32,SW¼,SW¼	EQ,T,F[b],S,G	Below Swegle Rd Br
	WW-9	32.9	T7E,R35E,Sect 31,SW¼,NW¼	S,T,F[b],W,G	Below Detour Rd Br
	WW-10	29.3	T7E,R34E,Sect 34,NW¼,NW¼	S,T,F[b]	Above McDonald Rd Br
	WW-11	27.4	T7E,R34E,Sect 29,SW¼,SW¼	S,F[b],W	Above Lowden/Gardena Rd
	WW-12	26.6	T7E,R34E,Sect 31,NW¼,NE¼	T	Borgens Rd
Mud Creek	MC-1	2.7	T8N,R38E,Sect 31,NW¼,SW¼	EL	2.3 mi up Mud Ck Rd
	MC-2	0.1	T8N,R37E,Sect 26,SW¼,NE¼	EL	1st culvert
Yellowhawk Crk	YC-1	7.0	T7N,R36E,Sect 27,NW¼,NE¼	T[c]	Carl St.
	YC-2	1.7	T6N,R35E,Sect 1,SE¼,NW¼	T	Above Pepper Bridge Rd Br

[a] EQ - Quantitative Electrofishing (density estimates); EL - Qualitative electrofishing; S - Snorkel; T - Temperature; F - Flow; W - Water Quality; G - Flow gauge.
[b] Index discharge sites.
c Temperature logger removed on 6/30/99.
[d] River mile.

Appendix B. Discharge Data 1999 & 1998

Appendix B. Table 1. Manual Flow Data Summary 1999.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
NF Touchet R	NFT-1	9/2	**1.2**	41.5	13:35	100 yards above Bluewood turnoff
NF Touchet R	NFT-3	10/5	**6.0**	43.0	10:05	below mouth of Spangler Creek
		10/14	**6.3**	44.5	10:09	
		11/19	**8.2**	42.0	13:40	
NF Touchet R	NFT-5	9/21	**33.1**	54.0	14:08	75 ft above mouth of Jim Creek
Spangler Creek	SC-1	9/17	**3.2**	47.0	9:50	0.2 mi up Spangler Creek
		10/14	**2.7**	44.5	9:00	
Lewis Creek	LC-4	8/25	**6.2**	54.5	13:14	Lewis Creek Cabins
Lewis Creek	LC-6	10/5	**5.5**	46.0	9:35	above N. Fork Touchet Rd
		10/14	**5.9**	47.0	10:34	
Jim Creek	JC-2	10/5	**2.1**	47.0	9:55	0.5 mi above N. Fork Touchet Rd
		10/14	**2.3**	49.5	11:02	
Wolf Fork	WF-1	9/10	**16.7**	48.0	14:00	3 mi above Coates Creek
		9/19	**16.5**	48.0	14:41	
		10/5	**15.4**	45.0	11:50	
		10/14	**16.8**	43.5	11:47	
Wolf Fork	WF-9	9/17	**22.0**	56.0	11:35	3 mi up Wolf Fork Rd
		10/14	**22.6**	51.5	15:00	
Coates Creek	C-6	10/5	**1.6**	46.0	10:57	Above yellow gate
		10/14	**2.6**	45.5	12:52	
Whitney Creek	WC-1	9/17	**4.6**	50.0	10:55	0.2 mi up Whitney Creek
		10/5	**3.2**	46.0	11:20	
		10/14	**4.6**	48.0	12:33	
Robinson Fork	RF-4	10/5	**1.2**	47.0	13:13	4.5 mi above last Br.
		10/14	**1.3**	45.5	13:45	
Robinson Fork	RF-8	9/9	**0.7**	61.0	14:23	below last Br.
		10/5	**0.7**	55.0	12:32	
		10/14	**0.8**	55.0	14:33	
Green Fork	GF-1	9/8	**0.2**	46.0	10:45	Right fork upper Green Fork
Green Fork	GF-3	10/28	**1.7**	43.0	11:15	Mainstem
Green Fork	GF-5	9/8	**0.4**	45.5	10:25	One mile below wooden Br.
Burnt Fork	BF-3	10/28	**7.0**	41.0	11:55	0.2 mi above S. Fork Touchet
SF Touchet R	SFT-7	9/17	**2.8**	65.0	12:15	Gephart Rd off S.Fork Touchet Rd
		10/5	**2.3**	58.0	14:05	
		10/14	**2.8**	56.5	15:20	
		11/19	**6.8**	47.0	14:40	

Appendix B. Table 1. Manual Flow Data Summary 1999 (continued).

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Patit Creek	PC-2	5/3	**28.0**	44.5	9:27	below Range Grade Rd Br.
		6/2	**4.9**	52.5	16:40	
		6/15	**1.5**	74.0	13:00	
		7/8	**N/A**	N/A	N/A	*Creek bed dry
SF Patit Creek	SFP-2	10/8	**0.5**	48.0	9:48	200 ft above end of road
Touchet River	TR-3	5/17	**220.0**	47.5	9:05	Football field in Dayton
		6/4	**239.8**	62.0	14:35	
		6/15	**197.9**	67	13:30	
		7/8	**83.4**	56.5	8:48	
		7/14	**68.7**	52.0	9:12	
		7/29	**58.5**	68.5	11:40	
		8/11	**61.0**	66.0	12:05	
		9/1	**52.1**	54.0	8:55	
		9/17	**43.1**	55.0	8:55	
		9/29	**43.9**	57.5	15:45	
		10/13	**48.3**	57.0	14:25	
		11/4	**76.7**	46.5	16:30	
		11/19	**62.7**	47.0	12:40	
Touchet River	TR-13	6/2	**338.0**	51.5	14:00	above Bolles Br.
		6/14	**214.5**	70.0	16:05	
		7/7	**91.1**	65.0	12:30	
		7/14	**68.0**	64.0	10:05	
		7/29	**50.0**	70.0	8:50	
		8/11	**52.6**	68.0	8:30	
		8/30	**48.3**	62.0	14:33	
		9/15	**43.2**	68.0	14:48	
		9/29	**47.8**	54.0	12:00	
		10/13	**50.4**	59.0	13:50	
		11/4	**76.1**	47.0	14:25	
		11/19	**78.5**	46.0	11:55	
Touchet River	TR-16	6/1	**340.3**	61.0	14:36	below Simms Road Br.
		6/9	**208.7**	64.0	15:05	- flow monitor installed
		6/30	**104.7**	75.0	14:25	
		7/13	**59.2**	80.0	13:45	
		7/28	**38.7**	- -	14:43	
		8/11	**34.1**	74.0	9:45	
		8/30	**26.7**	66.0	15:53	
		9/15	**30.3**	67.0	14:00	
		9/28	**32.8**	58.0	16:05	
		10/13	**43.6**	58.0	13:00	
		11/4	**64.9**	47.0	13:35	
		11/18	**71.2**	44.0	10:26	
		11/28	**250.3**	43.0	13:13	

Appendix B. Table 1. Manual Flow Data Summary 1999 (continued).

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Touchet River	TR-17	6/9	**177.7**	66.0	16:00	1.5 miles up N. Touchet River Rd
		6/30	**72.5**	73.5	13:50	- flow monitor installed
		7/13	**32.3**	78.0	13:00	.3 mi above Markham Rd
		7/28	**17.8**	85.0	15:09	
		8/11	**11.8**	74.0	10:30	
		8/24	**8.2**	77.0	17:10	
		9/15	**8.9**	66.0	13:05	
		9/28	**15.5**	57.0	15:20	
		10/13	**32.3**	59.0	12:30	
		11/4	**60.4**	48.0	13:10	
		11/18	**66.4**	44.5	11:04	
SF Coppei Ck	SFC-3	7/29	**1.2**	67.0	9:55	3.45 mi up SF Coppei Crk Rd
		8/10	**1.3**	67.0	10:50	
		8/30	**1.4**	59.0	10:38	
		9/17	**1.3**	60.5	13:30	
		9/29	**1.5**	52.0	12:45	
		10/13	**1.2**	49.0	9:00	
		11/4	**1.7**	45.5	15:15	
		11/19	**2.2**	46.0	10:35	
NF Coppei Ck	NFC-4	7/29	**1.2**	66.0	10:40	0.7 mi above N. Fork Coppei
		8/10	**1.3**	66.0	11:30	
		9/17	**1.5**	60.0	14:05	
		9/29	**1.7**	55.0	13:30	
		10/13	**2.9**	52.5	9:20	
		11/4	**2.0**	47.0	15:45	
		11/19	**2.0**	47.0	11:14	
Coppei Ck	MC-3	4/14	**41.2**	45.0	15:30	below Meinberg Road Br.
		4/29	**11.5**	53.0	16:04	
		6/1	**5.6**	56.0	9:50	
		6/15	**2.8**	67.0	10:20	
		7/7	**1.8**	64.5	13:05	
		7/14	**0.8**	59.0	10:25	
		8/24	**1.0**	67.0	9:30	
Dry Creek	DC-3	4/23	**28.2**	45.5	11:30	0.5 miles up Biscuit Ridge Rd
		5/24	**17.5**	66.0	14:20	
		6/3	**1.9**	63.5	15:36	
		6/14	**4.5**	63.0	10:15	
		6/30	**3.1**	61.0	9:00	
		7/13	**2.0**	61.0	9:05	
		7/28	**1.4**	64.0	9:07	
		8/10	**1.4**	69.0	12:50	
		8/23	**2.7**	65.0	- -	
		9/15	**2.2**	56.0	10:20	
		9/28	**2.2**	46.0	10:05	
		10/13	**2.7**	51.0	9:45	
		11/4	**2.5**	44.5	8:50	
		11/19	**3.7**	45.0	10:05	
NF Dry Creek	NFD-4	10/5	**0.9**	49.0	10:25	0.5 mi up Scott Rd

Appendix B. Table 1. Manual Flow Data Summary 1999 (continued).

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Walla Walla R	WW-1	6/14	**78.5**	64.5	12:42	above Pepper Br.
		6/30	**9.9**	62.5	10:10	
		7/13	**5.1**	65.0	10:10	
		7/28	**2.3**	71.0	11:36	
		8/10	**3.1**	74.0	14:25	
		9/15	**2.7**	60.0	10:22	
		9/28	**2.7**	56.0	11:55	
		10/5	**2.6**	59.0	13:25	
		10/13	**2.7**	57.0	10:25	
		11/4	**17.9**	48.0	9:35	
		11/18	**73.7**	47.0	14:30	
		11/23	**69.6**	44.0	12:30	
Walla Walla R	WW-5	4/22	**373.9**	49.0	12:47	below Mojonnier Rd
		6/1	**296.0**	53.5	11:22	
		6/9	**83.7**	55.5	11:25	- flow monitor installed
		6/30	**5.9**	64.5	10:43	
		7/13	**15.5**	66.0	10:30	
		7/28	**25.7**	70.5	10:54	
		8/10	**22.6**	75.0	15:15	
		8/23	**25.0**	- -	- -	
		9/15	**21.7**	60.0	10:45	
		9/28	**26.1**	54.0	12:55	
		10/5	**31.4**	55.0	11:35	
		10/13	**15.1**	55.0	10:45	
		10/18	**8.4**	48.0	11:29	
		11/4	**6.1**	48.0	10:00	
		11/18	**20.8**	47.5	14:10	
		11/23	**22.1**	42.5	11:52	
Walla Walla R	WW-8	6/1	**287.6**	55.5	12:20	below Swegle Rd Br.
		6/9	**85.6**	59.5	12:27	- flow monitor installed
		6/30	**7.0**	69.0	11:55	
		7/13	**17.5**	73.0	11:25	
		7/28	**23.7**	79.0	13:56	
		8/10	**23.6**	77.0	15:50	
		8/23	**24.9**	- -	- -	
		9/15	**26.6**	62.0	11:40	
		9/28	**31.3**	56.0	13:30	
		10/13	**20.4**	56.0	11:05	
		11/4	**12.1**	48.0	10:45	
		11/18	**27.0**	47.5	11:30	
Walla Walla R	WW-9	5/12	**400.4**	53.5	9:50	below Detour Rd Br.
		6/1	**403.4**	58.0	13:07	
		6/9	**121.9**	- -	13:16	- flow monitor installed
		6/30	**15.9**	70.5	12:34	
		7/13	**19.2**	75.0	12:06	
		7/28	**26.8**	77.0	13:09	
		8/10	**30.6**	78.0	14:45	
		8/24	**32.6**	77.0	13:55	
		9/15	**29.0**	63.0	11:55	
		9/28	**35.4**	56.0	14:08	
		10/13	**31.8**	57.0	11:40	
		11/4	**21.2**	49.5	11:15	
		11/18	**41.2**	48.5	13:09	

Appendix B. Table 1. Manual Flow Data Summary 1999 (continued).

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Walla Walla R	WW-10	7/13	**6.7**	77.0	12:38	above McDonald Rd Br.
		8/10	**9.1**	79.0	16:45	
		8/23	**11.4**	- -	- -	
		9/15	**12.1**	62.0	12:45	
		9/28	**14.5**	61.0	14:45	
		10/13	**15.8**	60.0	12:00	
		11/4	**12.6**	51.0	12:00	
		11/18	**21.5**	49.5	12:40	

Appendix B. Table 2. Manual Flow Data Summary 1998.

Stream	Site	Date	CFS	Temp(F)	Time	Comments
Walla Walla R	WW-1	7/27	**3.16**	77.5	13:52	above Pepper Br.
		8/3	**3.42**	79.0	15:21	
		8/17	**3.09**	68.0	11:40	
		9/1	**2.79**	74.5	15:15	
		9/16	**3.32**	64.5	9:48	
		10/16	**2.86**	50.5	8:03	
		10/28	**3.22**	53.5	11:18	
		11/14	**94.90**	49.0	12:00	
Walla Walla R	WW-5	7/9	**29.48**	72.0	11:30	below Mojonier Rd
		720	**36.05**	78.0	15:03	
		8/3	**25.77**	82.0	16:18	
		8/17	**25.14**	69.0	13:00	
		9/1	**28.30**	74.5	14:30	
		9/16	**35.01**	69.0	12:10	
		10/16	**1.83**	50.5	9:43	
		10/28	**13.72**	50.5	10:25	
		11/14	**59.54**	49.5	12:40	
Walla Walla R	WW-7	7/2	**3.43**	75.0	12:00	below Swegle Rd
		7/9	**31.65**	78.0	13:15	
		7/20	**35.52**	78.0	14:40	
		8/3	**27.22**	82.0	14:40	
		8/17	**21.66**	72.0	14:05	
		9/1	**25.55**	73.3	13:45	
		9/16	**37.28**	72.0	14:15	
		10/16	**8.32**	53.0	11:15	
		10/26	**20.43**	51.0	9:15	
		11/14	**68.35**	50.8	13:14	
Walla Walla R	WW-9	7/9	**4.09**	84.0	15:00	below McDonald Rd Br
		7/20	**4.92**	82.0	13:30	
		8/3	**N/A**	82.5	14:04	No Flow - Gauge pulled
		8/17	**7.96**	79.0	15:00	
		9/1	**9.97**	75.0	12:58	
		9/17	**17.31**	68.0	11:00	
		10/16	N/A	N/A	N/A	No Flow Taken - Habitat construction-Lost temp logger
		11/5	**7.48**	51.0	15:58	
		11/14	**86.36**	51.8	13:55	
Walla Walla R	WW-11	7/27	**3.80**	84.0	12:55	below 1st pump house
		8/17	**N/A**	77.0	16:20	
		9/1	**2.42**	74.5	1230	
		9/28	**15.21**	71.0	13:13	
		10/16	**0.76**	50.0	11:25	
		10/28	**7.63**	49.5	8:10	
		11/14	**44.37**	50.0	14:30	

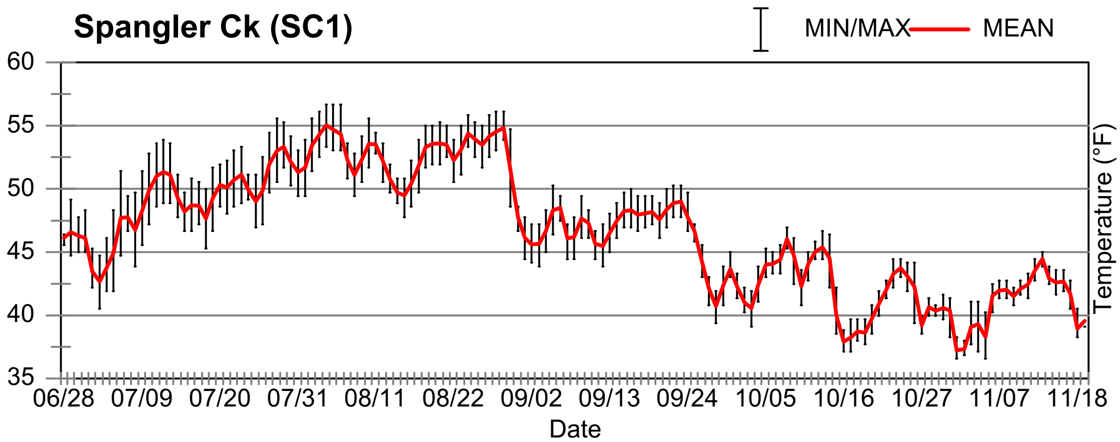
*Supplemental to Mendel et al, 1999.

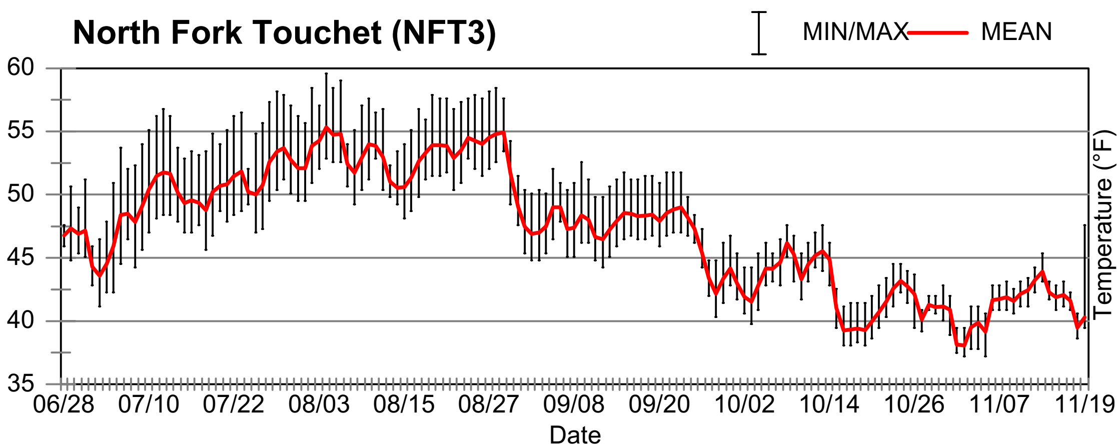
Appendix B. Table 2. Manual Flow Data Summary 1998 (continued).

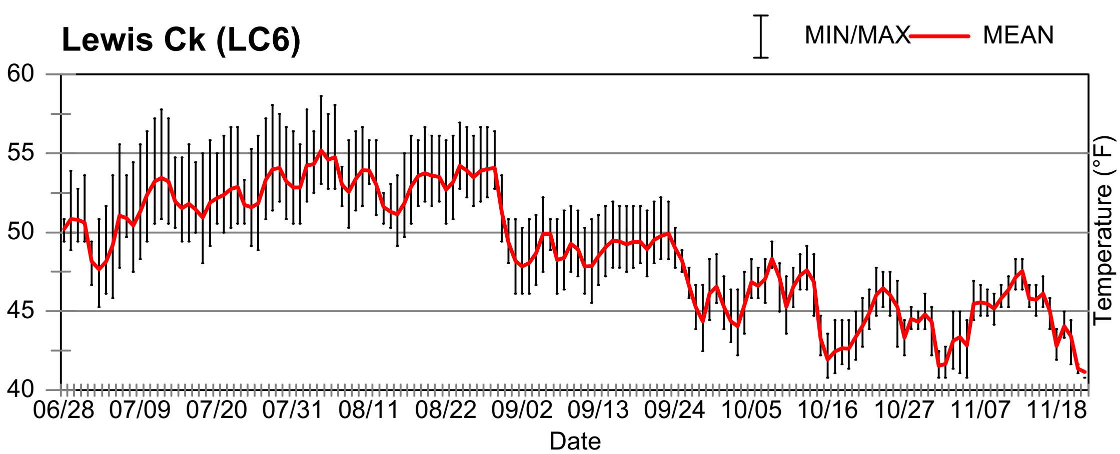
Stream	Site	Date	CFS	Temp(F)	Time	Comments
Touchet R	TR-5	7/20	**20.43**	74.0	15:53	Dayton football fields
		7/20	**60.3**	62.0	8:40	
		8/3	**45.59**	79.0	17:50	
		8/25	**45.07**	N/A	N/A	
		9/1	**38.30**	72.0	17:45	
		9/18	**42.95**	62.0	13:00	
		10/12	**51.17**	52.5	14:00	
		10/28	**55.85**	50.0	15:21	
		11/5	**56.22**	47.0	10:30	
Touchet R	TR-17	7/8	**71.00**	77.5	13:41	at Knotgrass Rd
		7/20	**44.07**	67.0	9:15	
		8/3	**46.74**	69.0	7:45	
		8/19	**41.31**	72.0	14:01	
		9/18	**38.03**	60.0	10:33	
		10/28	**59.78**	51.0	13:35	
		11/5	**66.12**	47.5	11:17	
Touchet R	TR-19	7/27	**43.96**	73.0	11:00	above Bolles Br.
		8/3	**48.62**	72.0	9:15	
		8/19	**39.54**	74.0	14:45	
		9/1	**38.33**	64.5	8:15	
		10/6	**52.75**	49.8	8:00	
Touchet R	TR-24	7/20	**39.06**	73.0	10:40	below Harshaw Rd
		8/3	**37.98**	79.0	11:08	
		8/19	**33.45**	73.0	13:02	
		9/1	**30.10**	67.0	8:35	
		9/18	**32.87**	61.0	9:30	
		10/6	**49.81**	55.3	13:30	
		10/23	**56.99**	50.0	13:00	
		11/5	**64.43**	47.8	12:50	
Touchet R	TR-28	6/26	**90.59**	68.5	14:00	below Simms Rd
		7/7	**54.42**	80.0	12:32	
		7/20	**33.45**	76.5	11:22	
		8/3	**37.68**	79.0	12:17	
		8/19	**28.44**	69.8	12:01	
		9/1	**26.17**	69.5	10:11	
		9/17	**26.49**	69.5	14:22	
		10/6	**45.32**	59.0	15:11	
		10/23	**55.42**	49.0	13:00	
		11/5	**65.10**	47.5	14:00	
Touchet R	TR-31	7/2	**14.14**	82.0	13:23	below Touchet Gunclub
		7/9	**32.87**	85.0	16:30	
		7/20	**13.07**	78.5	12:30	
		8/3	**20.32**	79.0	12:53	
		8/19	**8.32**	69.5	11:15	
		9/1	**2.48**	72.0	11:12	
		9/17	**6.90**	71.5	14:11	
		10/6	**34.42**	53.0	12:00	
		10/23	**39.75**	49.0	16:00	
		11/5	**57.58**	47.8	15:00	

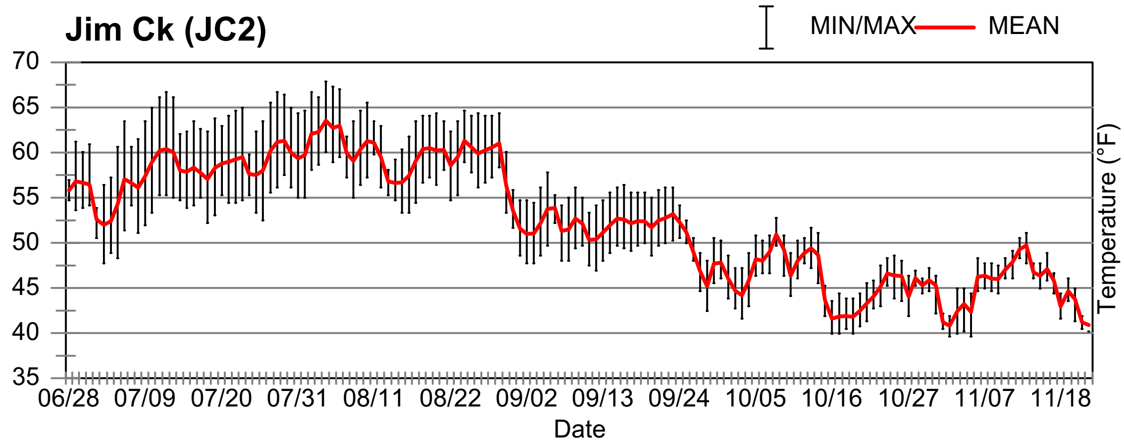
*Supplemental to Mendel et al, 1999.

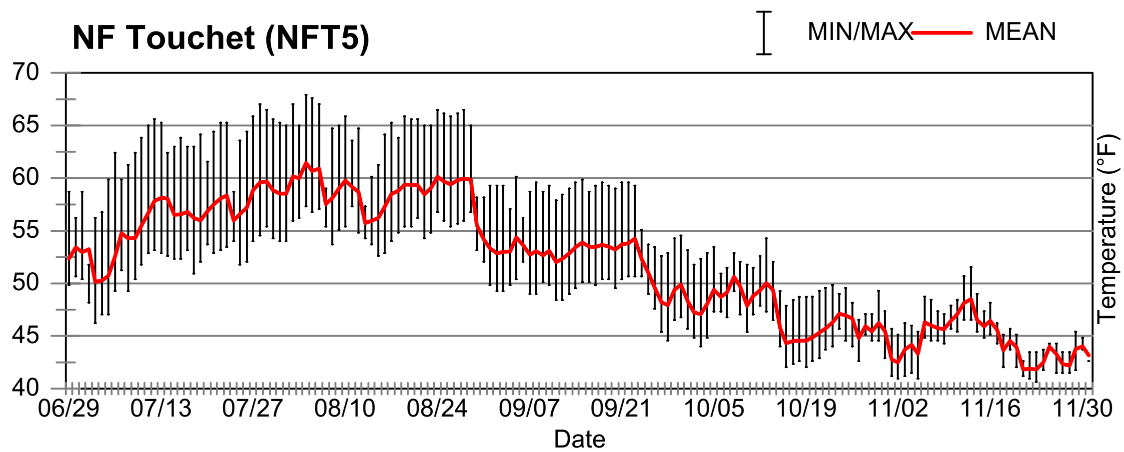
Appendix C - Stream Temperature Graphs (°F).

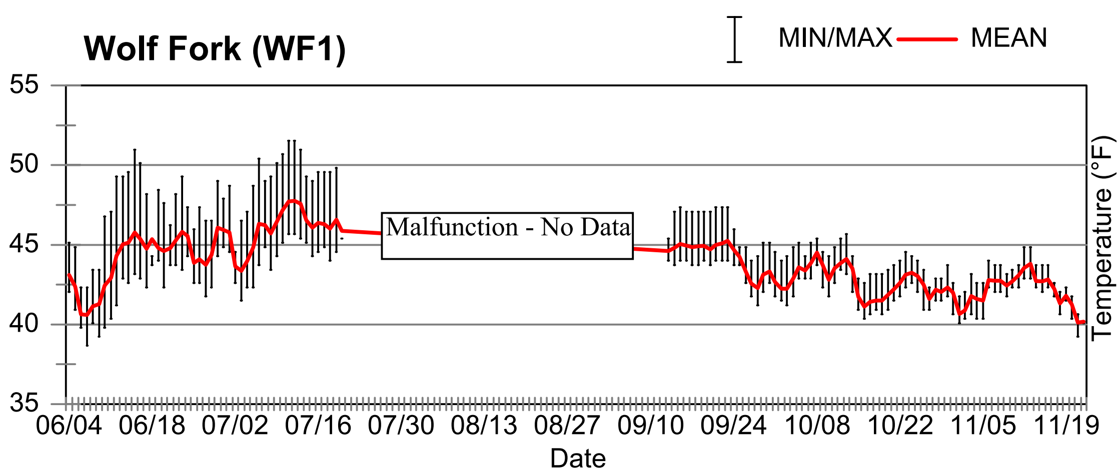

Spangler Ck (SC1)
MIN/MAX
MEAN
60
55
50
45
40
35
06/28 07/09 07/20 07/31 08/11 08/22 09/02 09/13 09/24 10/05 10/16 10/27 11/07 11/18
Date
Temperature (°F)

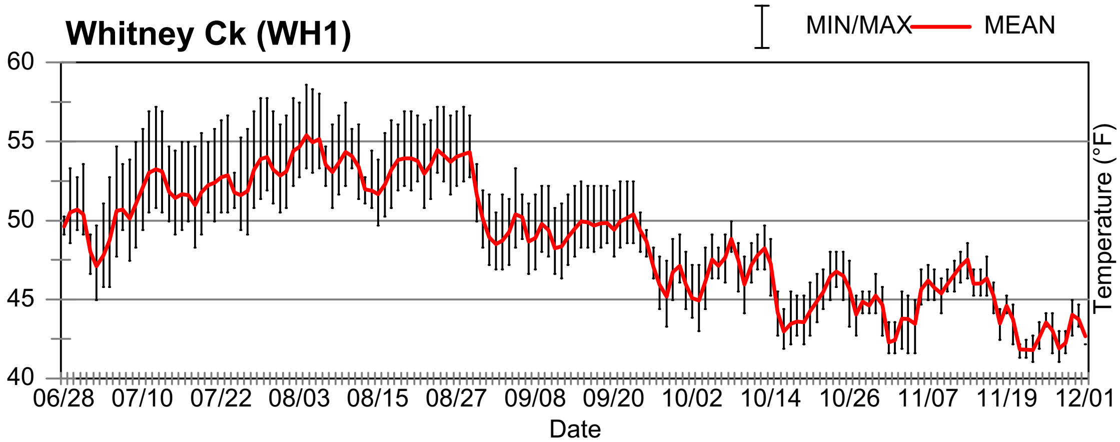

North Fork Touchet (NFT3)
MIN/MAX
MEAN
60
55
50
45
40
35
06/28 07/10 07/22 08/03 08/15 08/27 09/08 09/20 10/02 10/14 10/26 11/07 11/19
Date
Temperature (°F)

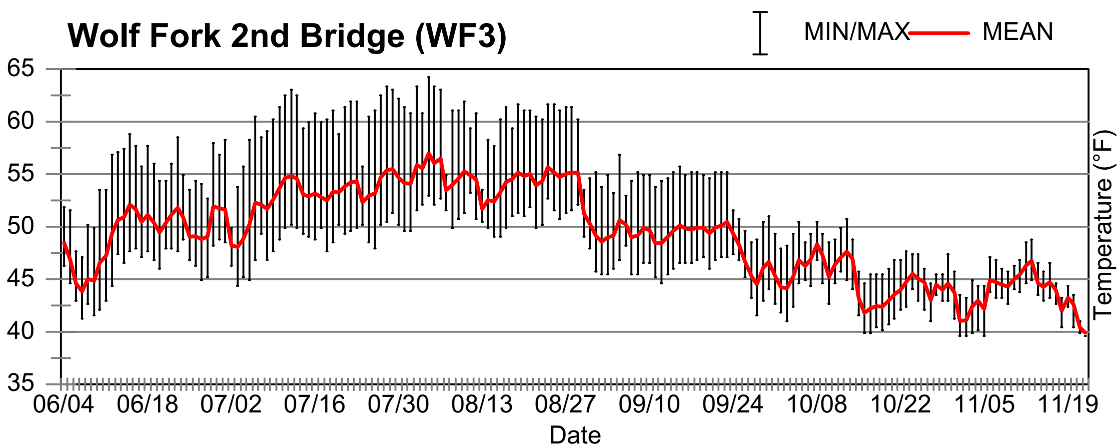

Lewis Ck (LC6)
MIN/MAX
MEAN
60
55
50
45
40
06/28 07/09 07/20 07/31 08/11 08/22 09/02 09/13 09/24 10/05 10/16 10/27 11/07 11/18
Date
Temperature (°F)

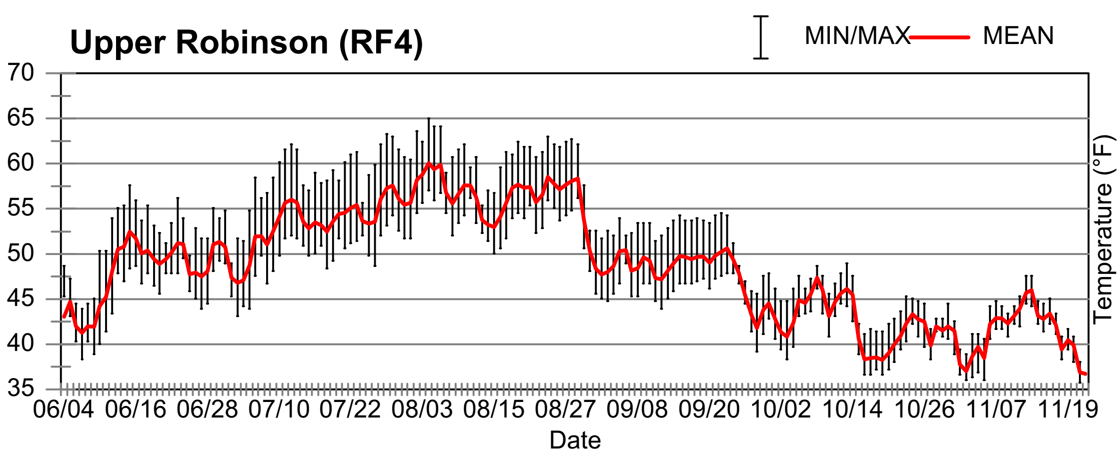

Jim Ck (JC2)
MIN/MAX
MEAN
70
65
60
55
50
45
40
35
06/28 07/09 07/20 07/31 08/11 08/22 09/02 09/13 09/24 10/05 10/16 10/27 11/07 11/18
Date
Temperature (°F)

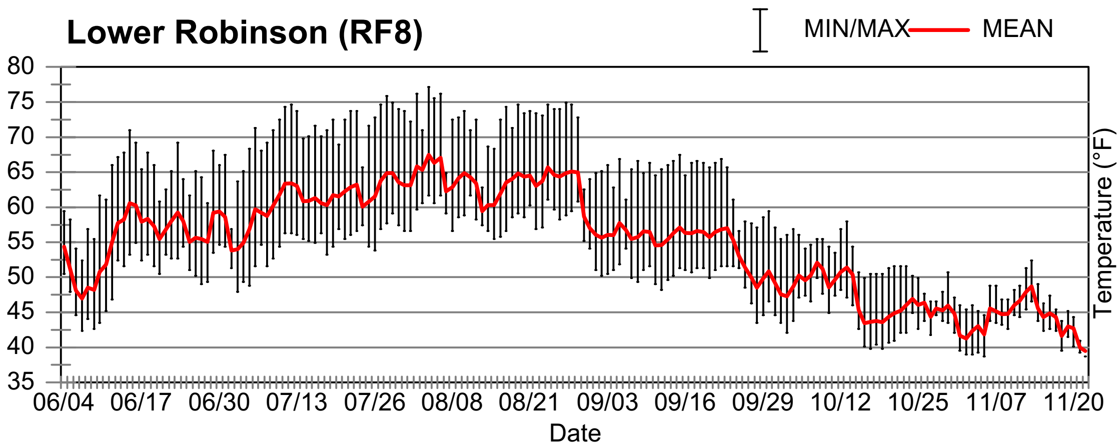

NF Touchet (NFT5)
MIN/MAX
MEAN
70
65
60
55
50
45
40
06/29 07/13 07/27 08/10 08/24 09/07 09/21 10/05 10/19 11/02 11/16 11/30
Date
Temperature (°F)


Wolf Fork (WF1)
MIN/MAX
MEAN
Malfunction - No Data
55
50
45
40
35
06/04 06/18 07/02 07/16 07/30 08/13 08/27 09/10 09/24 10/08 10/22 11/05 11/19
Date
Temperature (°F)

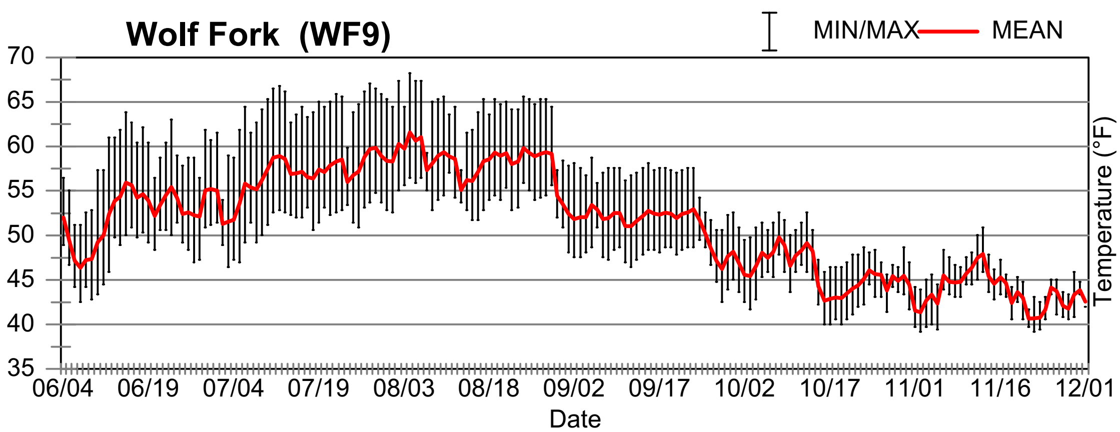

Whitney Ck (WH1)
MIN/MAX
MEAN
60
55
50
45
40
Temperature (°F)
06/28 07/10 07/22 08/03 08/15 08/27 09/08 09/20 10/02 10/14 10/26 11/07 11/19 12/01
Date


Wolf Fork 2nd Bridge (WF3)
MIN/MAX
MEAN
65
60
55
50
45
40
35
Temperature (°F)
06/04 06/18 07/02 07/16 07/30 08/13 08/27 09/10 09/24 10/08 10/22 11/05 11/19
Date

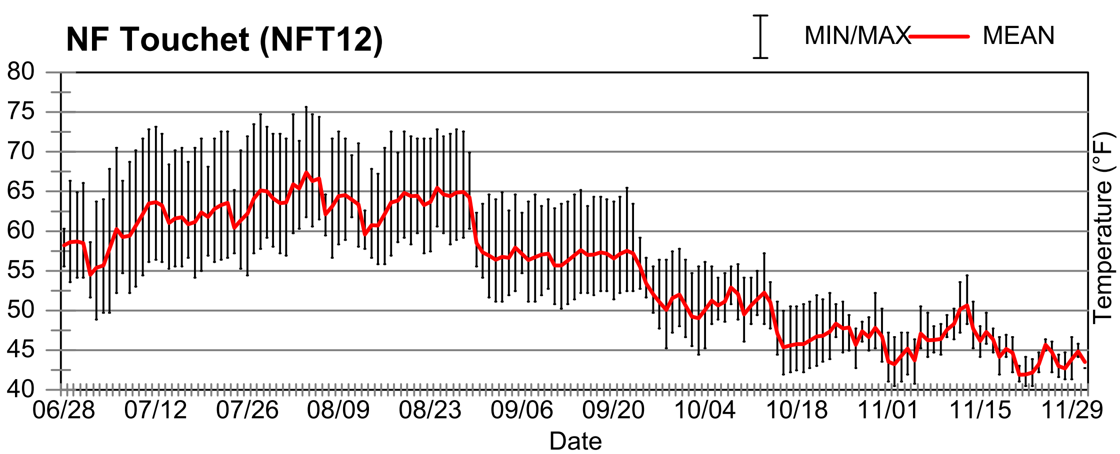

Upper Robinson (RF4)
MIN/MAX
MEAN
70
65
60
55
50
45
40
35
Temperature (°F)
06/04 06/16 06/28 07/10 07/22 08/03 08/15 08/27 09/08 09/20 10/02 10/14 10/26 11/07 11/19
Date



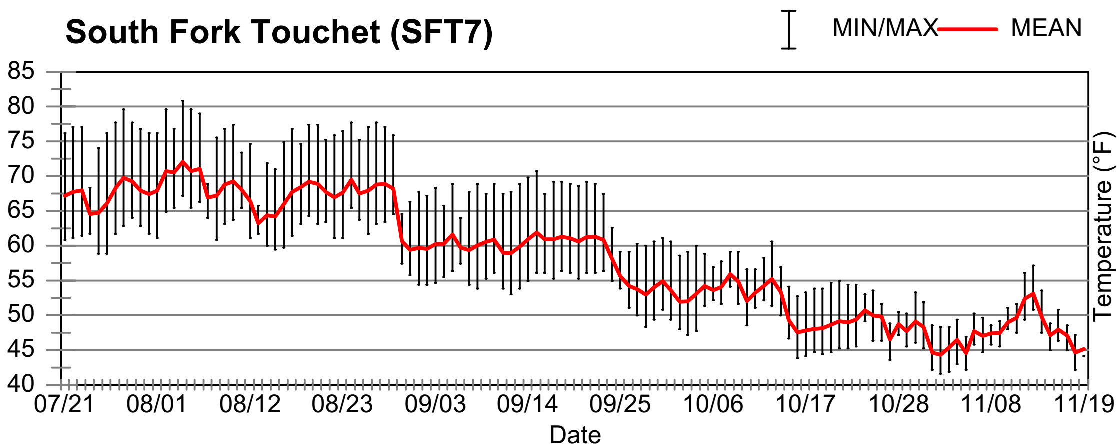
Lower Robinson (RF8)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
35
06/04
06/17
06/30
07/13
07/26
08/08
08/21
09/03
09/16
09/29
10/12
10/25
11/07
11/20
Date
Temperature (°F)

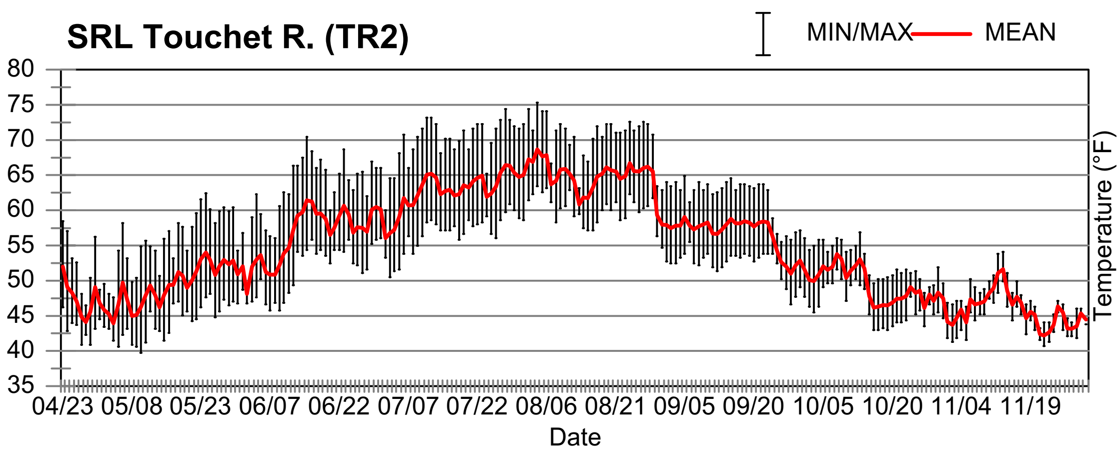


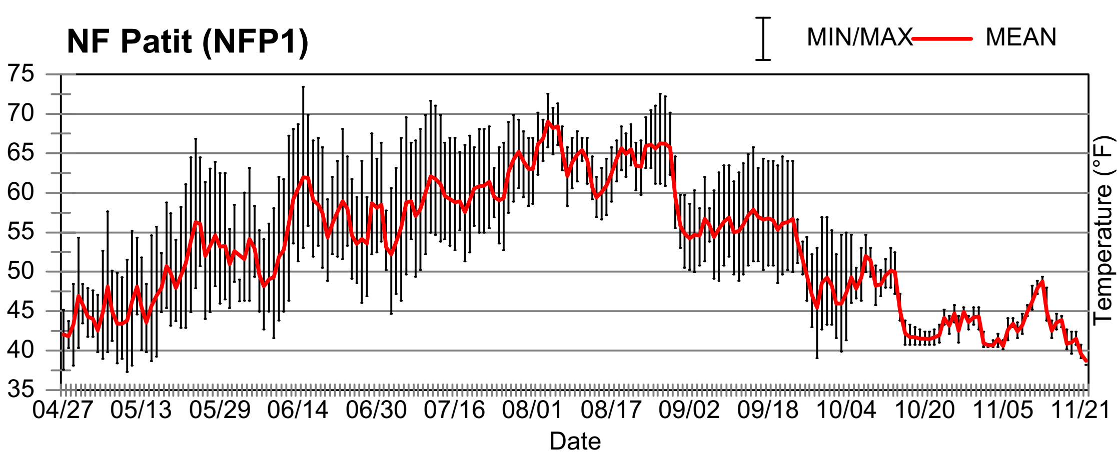
Wolf Fork (WF9)
MIN/MAX
MEAN
70
65
60
55
50
45
40
35
06/04
06/19
07/04
07/19
08/03
08/18
09/02
09/17
10/02
10/17
11/01
11/16
12/01
Date
Temperature (°F)

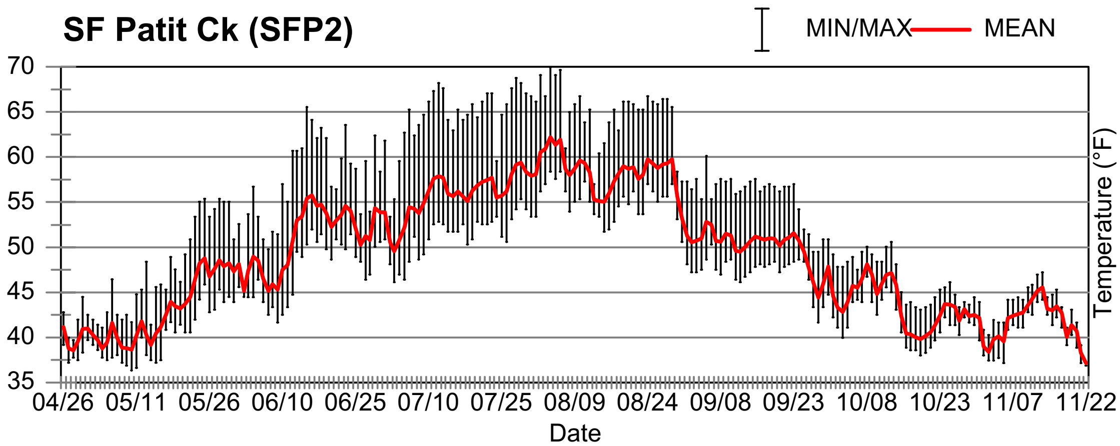


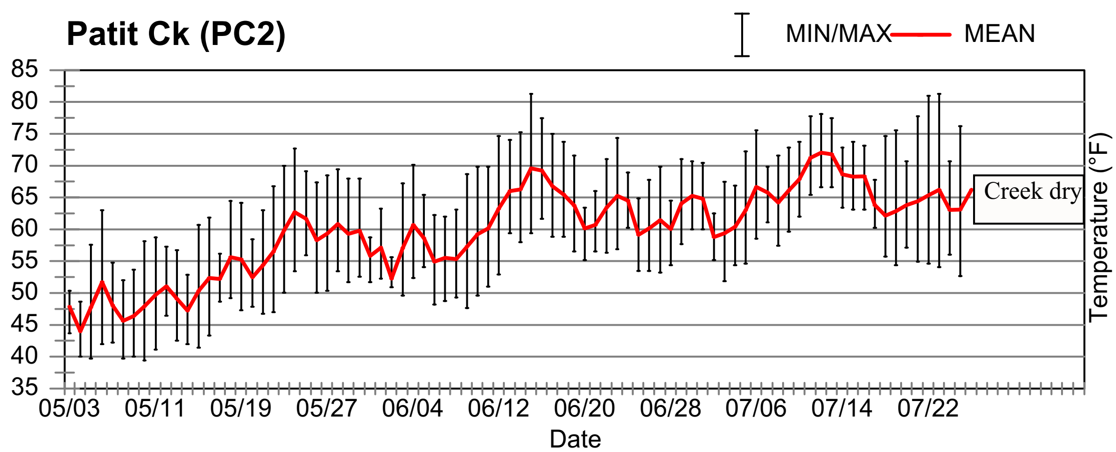
NF Touchet (NFT12)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
06/28
07/12
07/26
08/09
08/23
09/06
09/20
10/04
10/18
11/01
11/15
11/29
Date
Temperature (°F)

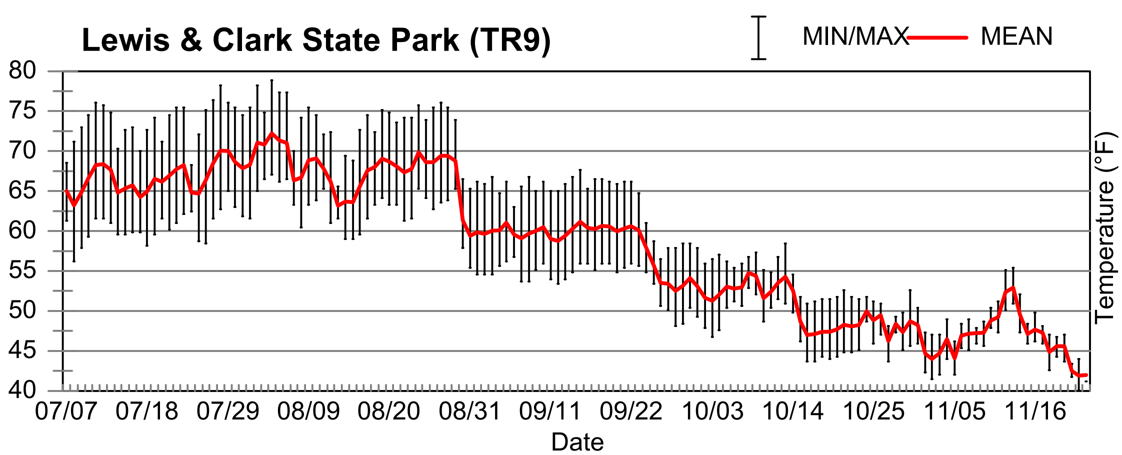

South Fork Touchet (SFT7)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
07/21
08/01
08/12
08/23
09/03
09/14
09/25
10/06
10/17
10/28
11/08
11/19
Date
Temperature (°F)

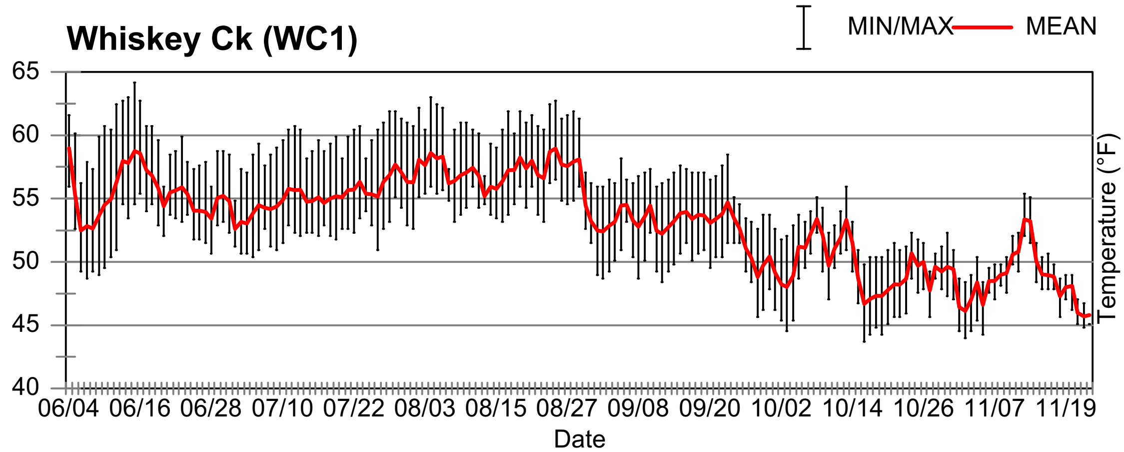

SRL Touchet R. (TR2)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
35
04/23
05/08
05/23
06/07
06/22
07/07
07/22
08/06
08/21
09/05
09/20
10/05
10/20
11/04
11/19
Date
Temperature (°F)

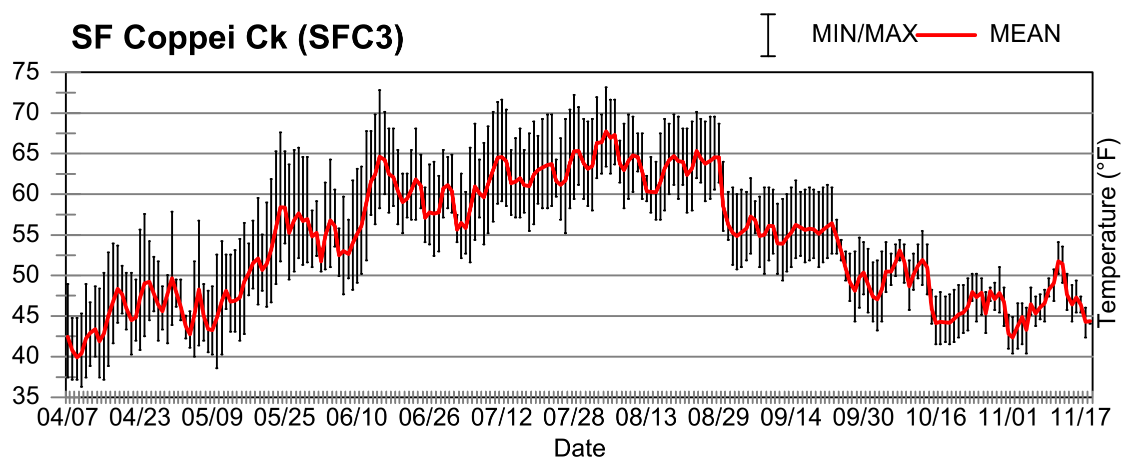

NF Patit (NFP1)
MIN/MAX
MEAN
75
70
65
60
55
50
45
40
35
04/27
05/13
05/29
06/14
06/30
07/16
08/01
08/17
09/02
09/18
10/04
10/20
11/05
11/21
Date
Temperature (°F)

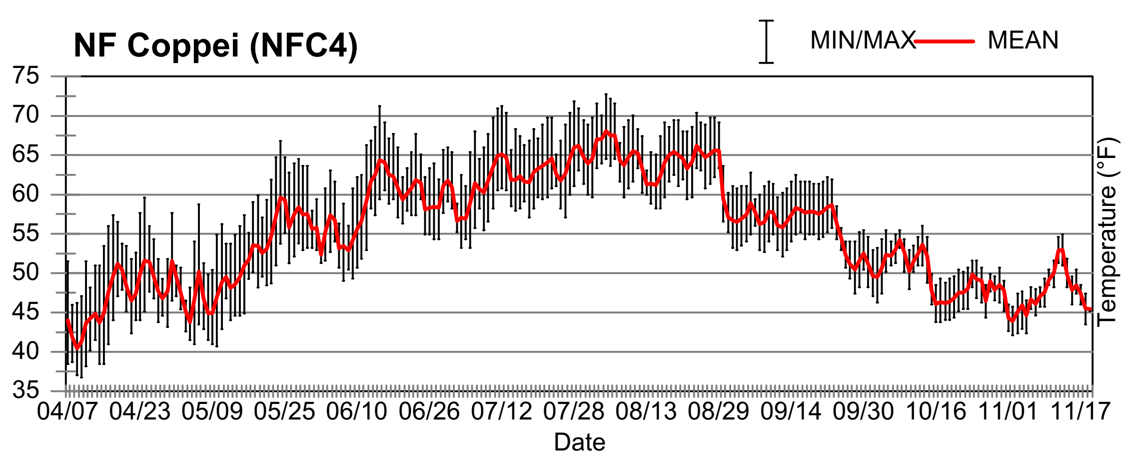

SF Patit Ck (SFP2)
MIN/MAX
MEAN
70
65
60
55
50
45
40
35
04/26
05/11
05/26
06/10
06/25
07/10
07/25
08/09
08/24
09/08
09/23
10/08
10/23
11/07
11/22
Date
Temperature (°F)

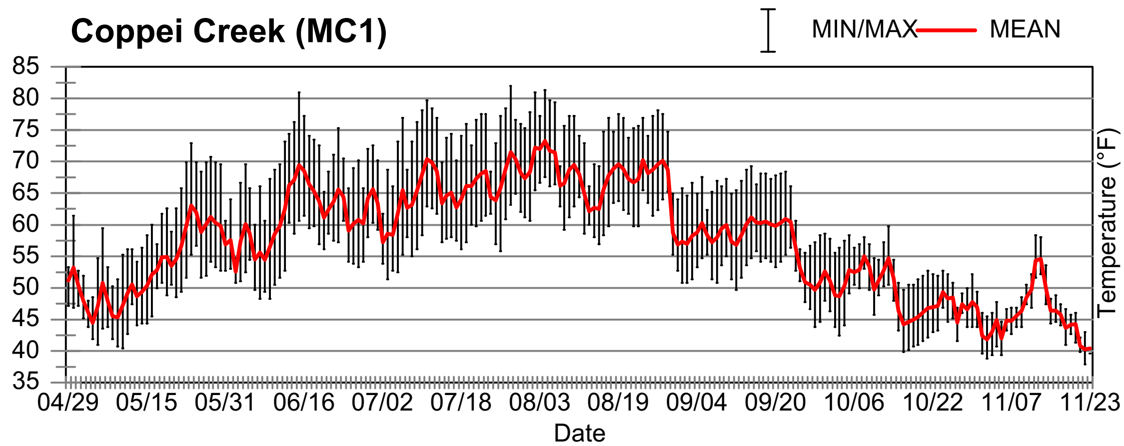

Patit Ck (PC2)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
35
05/03
05/11
05/19
05/27
06/04
06/12
06/20
06/28
07/06
07/14
07/22
Date
Creek dry
Temperature (°F)


Lewis & Clark State Park (TR9)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
07/07
07/18
07/29
08/09
08/20
08/31
09/11
09/22
10/03
10/14
10/25
11/05
11/16
Date
Temperature (°F)

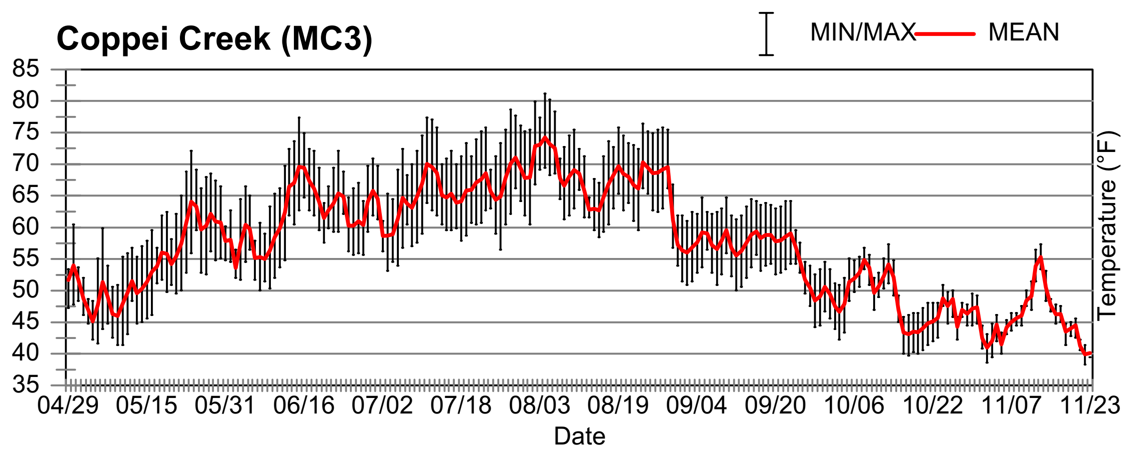

Whiskey Ck (WC1)
MIN/MAX
MEAN
65
60
55
50
45
40
06/04 06/16 06/28 07/10 07/22 08/03 08/15 08/27 09/08 09/20 10/02 10/14 10/26 11/07 11/19
Date
Temperature (°F)


SF Coppei Ck (SFC3)
MIN/MAX
MEAN
75
70
65
60
55
50
45
40
35
04/07 04/23 05/09 05/25 06/10 06/26 07/12 07/28 08/13 08/29 09/14 09/30 10/16 11/01 11/17
Date
Temperature (°F)

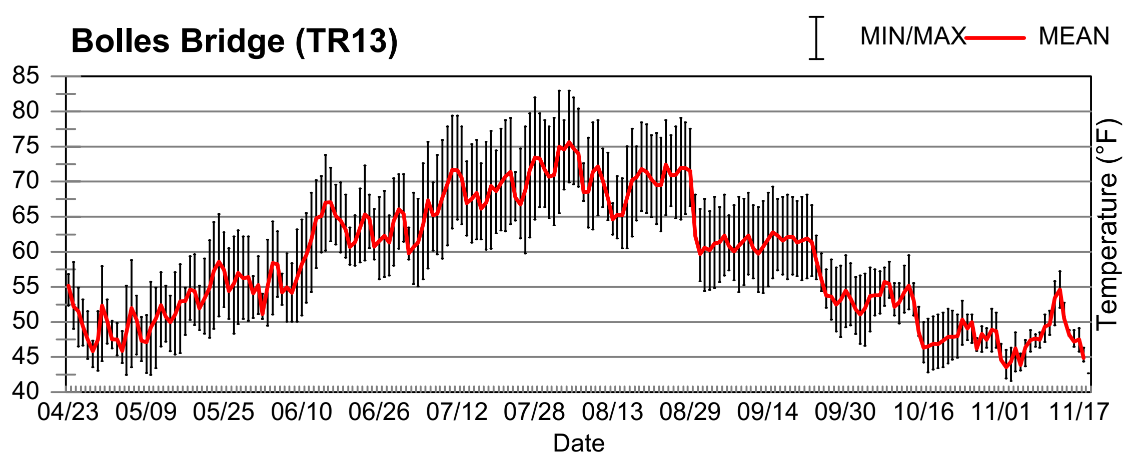

NF Coppei (NFC4)
MIN/MAX
MEAN
75
70
65
60
55
50
45
40
35
04/07 04/23 05/09 05/25 06/10 06/26 07/12 07/28 08/13 08/29 09/14 09/30 10/16 11/01 11/17
Date
Temperature (°F)



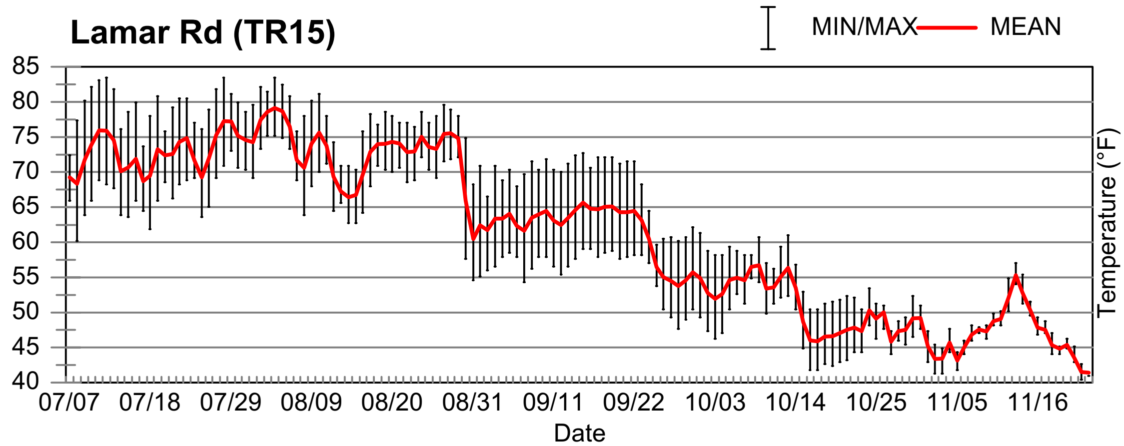
Coppei Creek (MC1)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
35
04/29 05/15 05/31 06/16 07/02 07/18 08/03 08/19 09/04 09/20 10/06 10/22 11/07 11/23
Date
Temperature (°F)

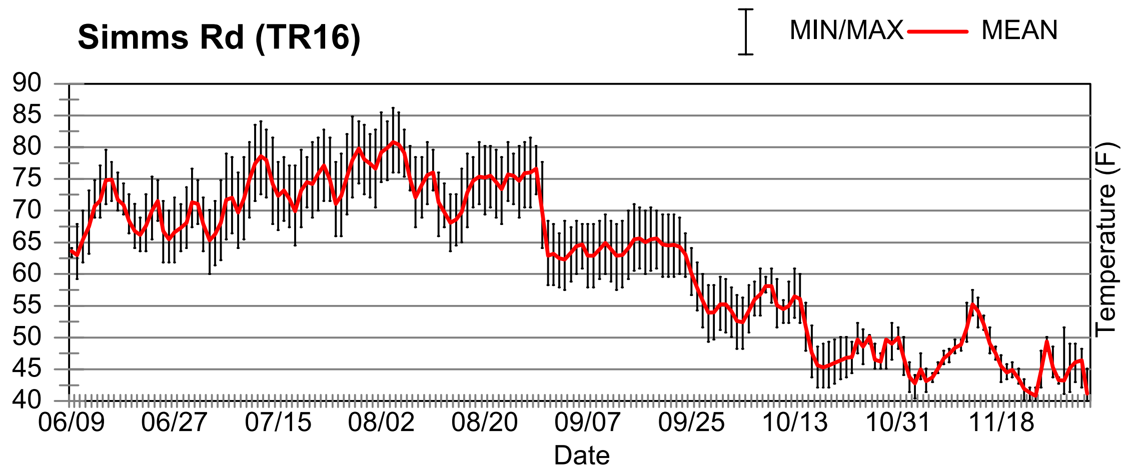


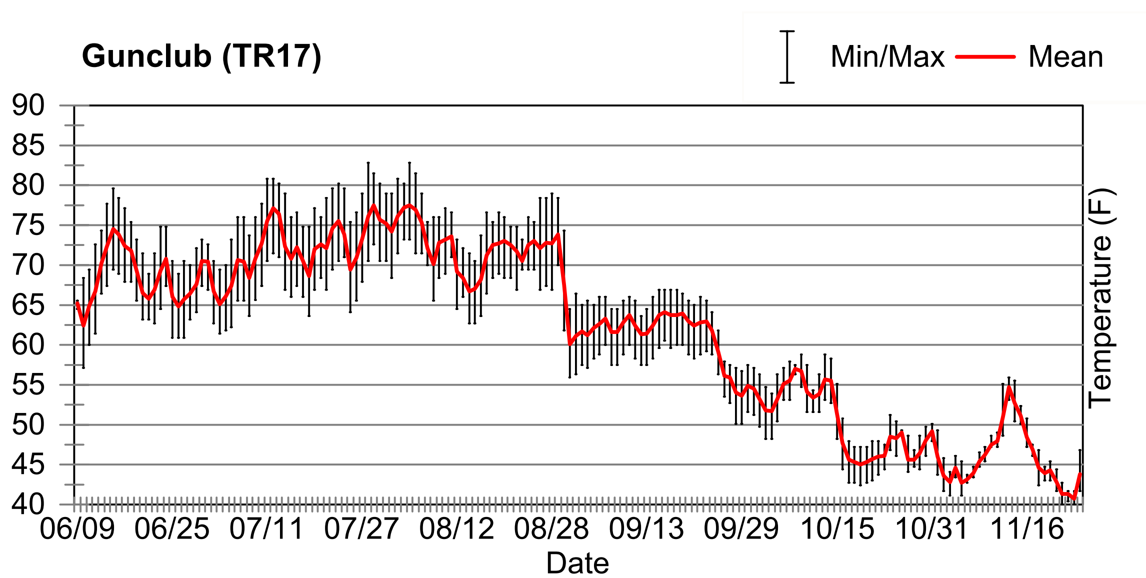
Coppei Creek (MC3)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
35
04/29 05/15 05/31 06/16 07/02 07/18 08/03 08/19 09/04 09/20 10/06 10/22 11/07 11/23
Date
Temperature (°F)

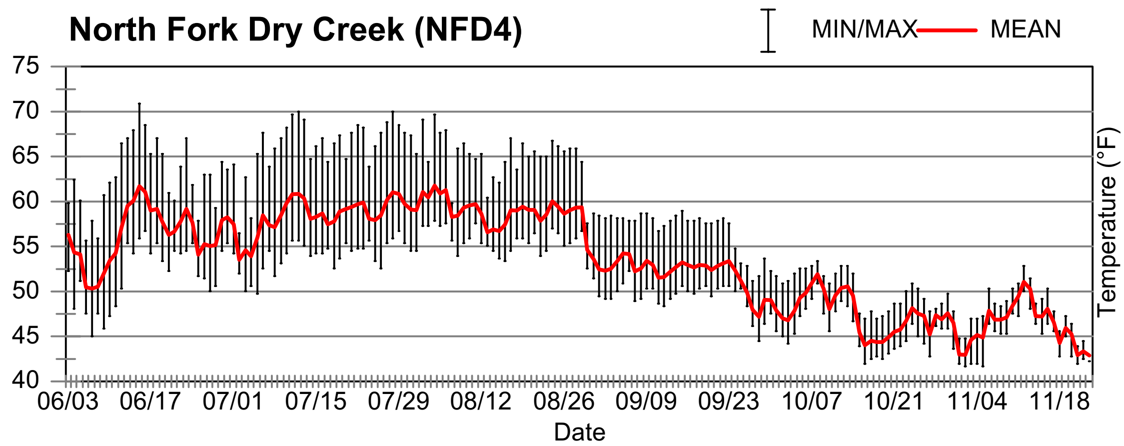


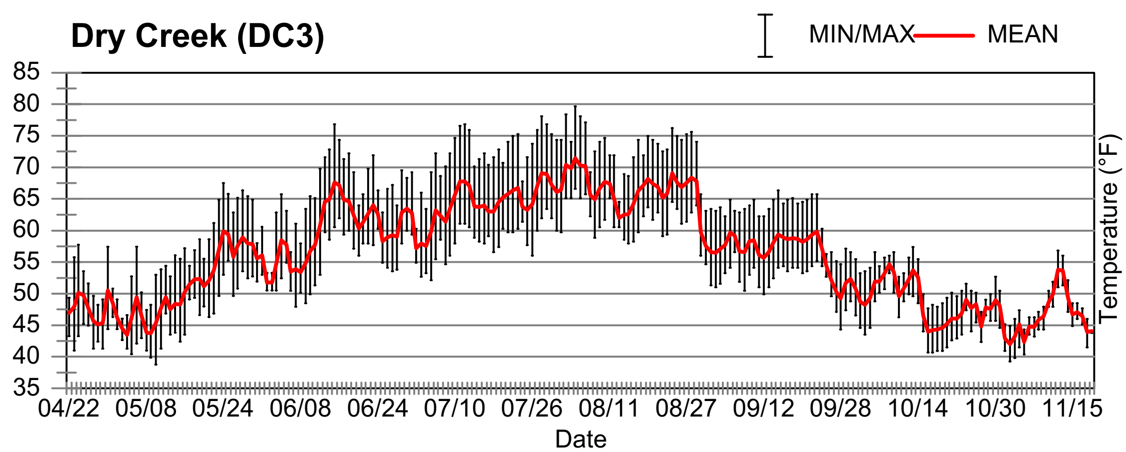
Bolles Bridge (TR13)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
04/23 05/09 05/25 06/10 06/26 07/12 07/28 08/13 08/29 09/14 09/30 10/16 11/01 11/17
Date
Temperature (°F)

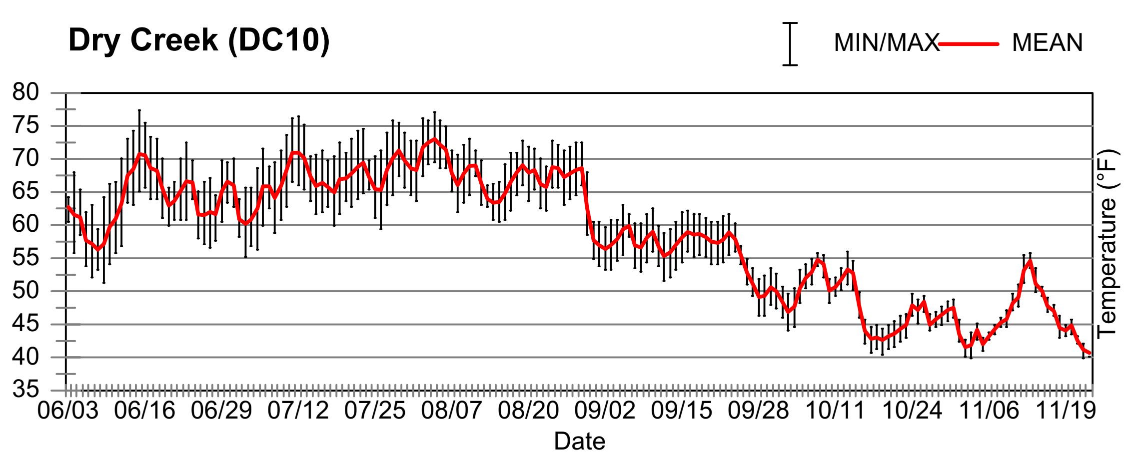

Lamar Rd (TR15)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
07/07 07/18 07/29 08/09 08/20 08/31 09/11 09/22 10/03 10/14 10/25 11/05 11/16
Date
Temperature (°F)

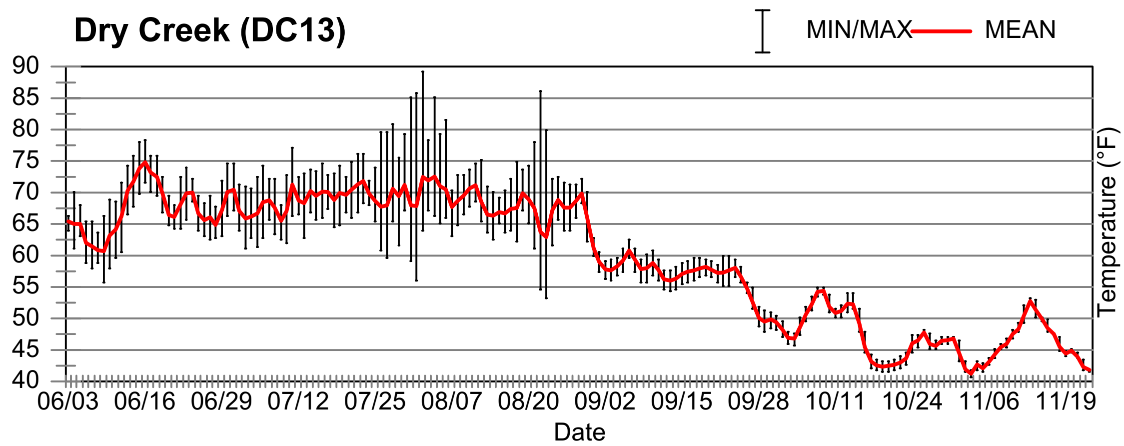

Simms Rd (TR16)
MIN/MAX
MEAN
90
85
80
75
70
65
60
55
50
45
40
06/09 06/27 07/15 08/02 08/20 09/07 09/25 10/13 10/31 11/18
Date
Temperature (F)

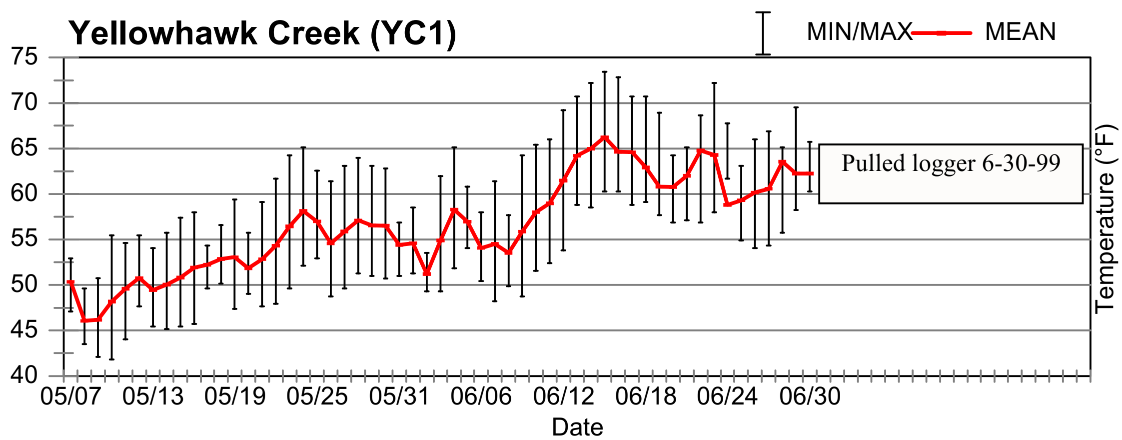

Gunclub (TR17)
Min/Max
Mean
90
85
80
75
70
65
60
55
50
45
40
06/09 06/25 07/11 07/27 08/12 08/28 09/13 09/29 10/15 10/31 11/16
Date
Temperature (F)

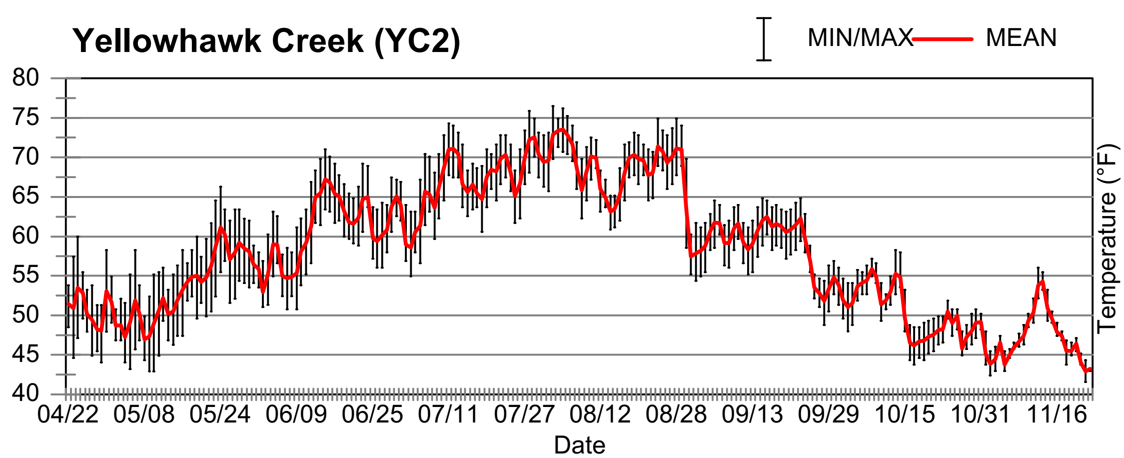

North Fork Dry Creek (NFD4)
MIN/MAX
MEAN
75
70
65
60
55
50
45
40
06/03 06/17 07/01 07/15 07/29 08/12 08/26 09/09 09/23 10/07 10/21 11/04 11/18
Date
Temperature (°F)

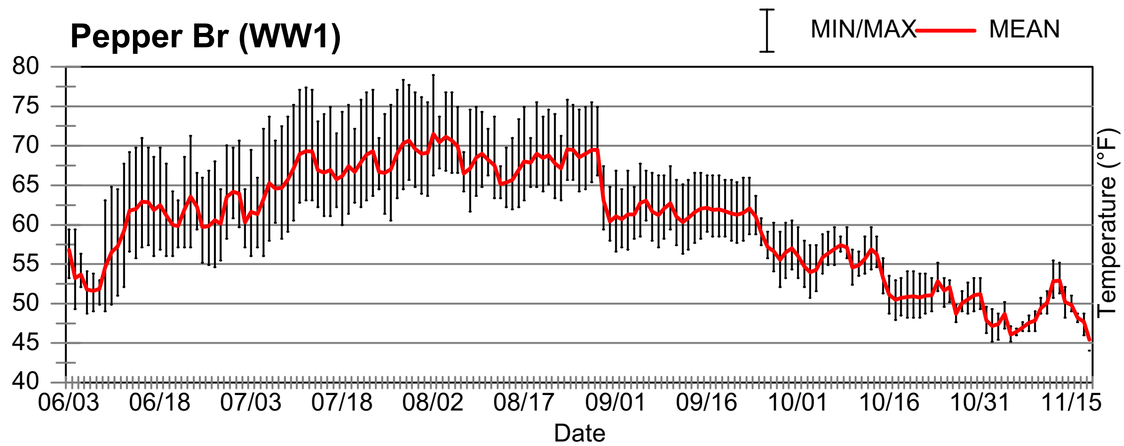

Dry Creek (DC3)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
35
04/22 05/08 05/24 06/08 06/24 07/10 07/26 08/11 08/27 09/12 09/28 10/14 10/30 11/15
Date
Temperature (°F)

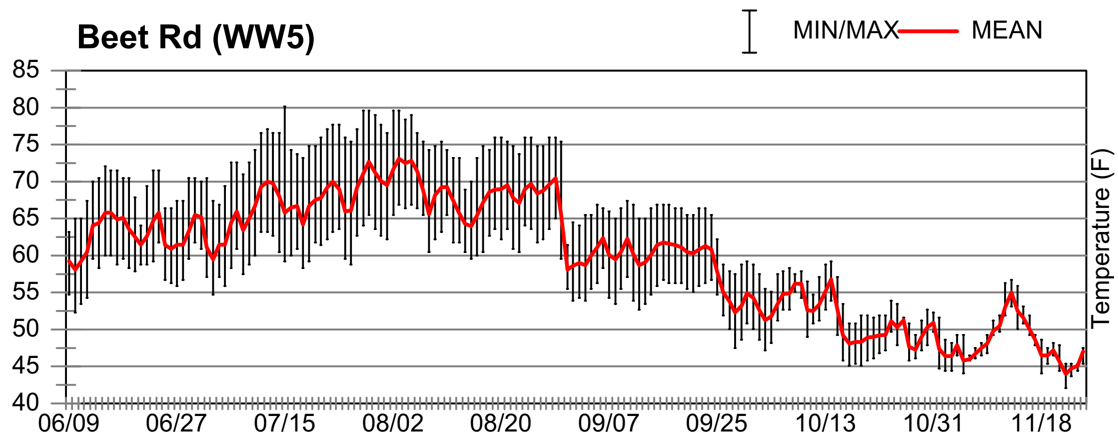

Dry Creek (DC10)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
35
06/03 06/16 06/29 07/12 07/25 08/07 08/20 09/02 09/15 09/28 10/11 10/24 11/06 11/19
Date
Temperature (°F)

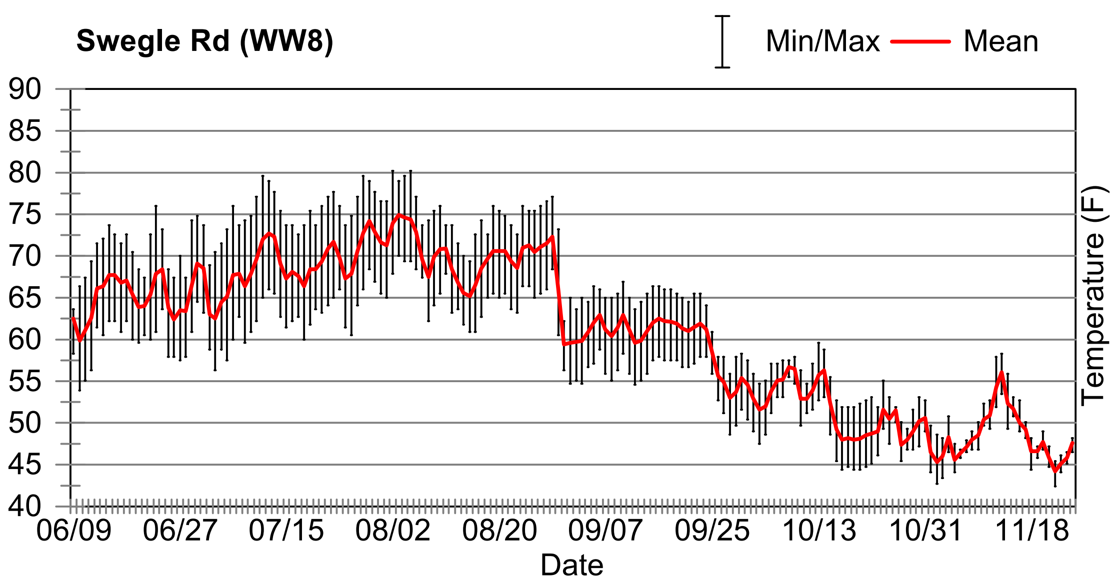

Dry Creek (DC13)
MIN/MAX
MEAN
90
85
80
75
70
65
60
55
50
45
40
06/03 06/16 06/29 07/12 07/25 08/07 08/20 09/02 09/15 09/28 10/11 10/24 11/06 11/19
Date
Temperature (°F)

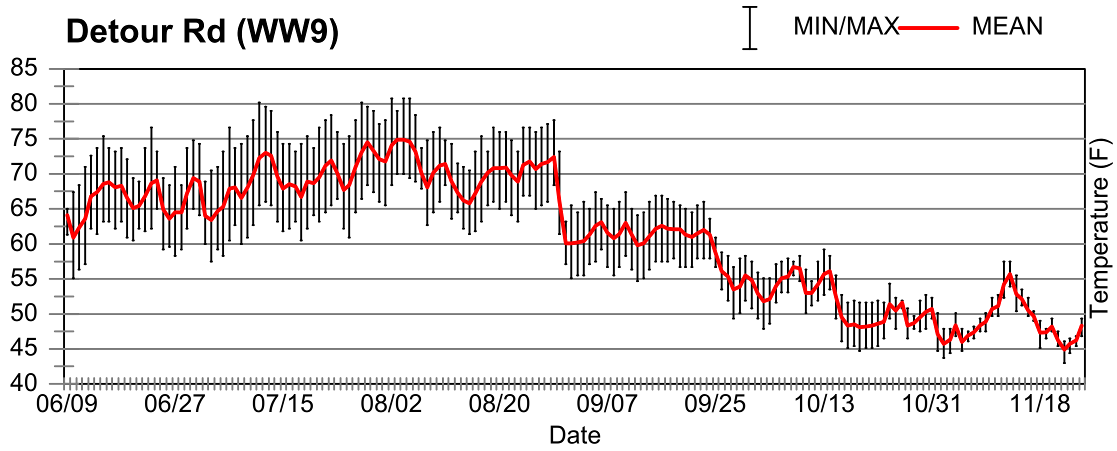

Yellowhawk Creek (YC1)
MIN/MAX
MEAN
75
70
65
60
55
50
45
40
05/07 05/13 05/19 05/25 05/31 06/06 06/12 06/18 06/24 06/30
Date
Temperature (°F)
Pulled logger 6-30-99

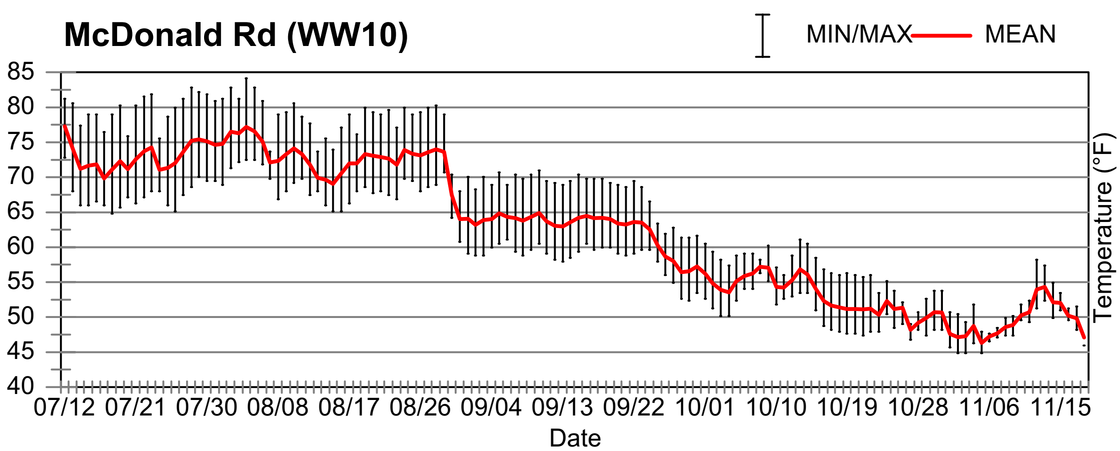

Yellowhawk Creek (YC2)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
04/22 05/08 05/24 06/09 06/25 07/11 07/27 08/12 08/28 09/13 09/29 10/15 10/31 11/16
Date
Temperature (°F)

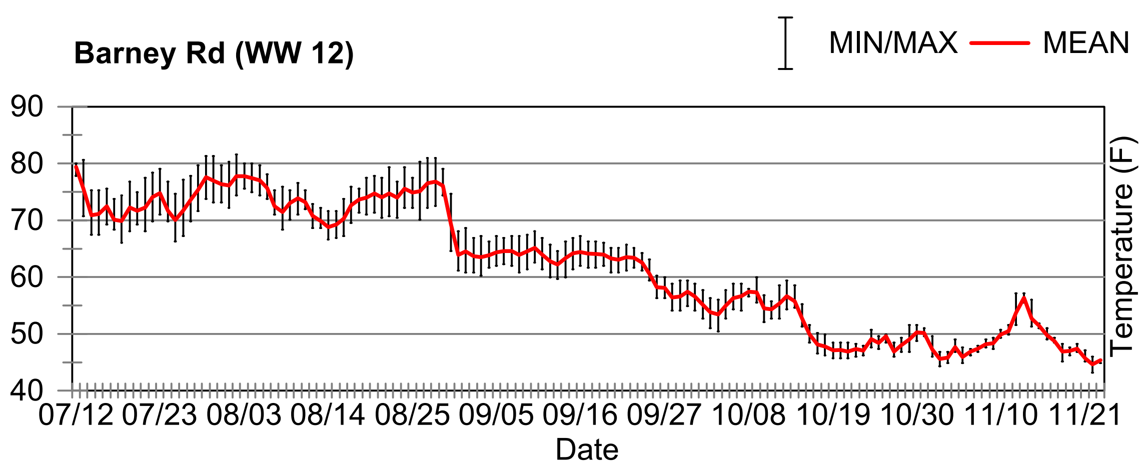

Pepper Br (WW1)
MIN/MAX
MEAN
80
75
70
65
60
55
50
45
40
06/03
06/18
07/03
07/18
08/02
08/17
09/01
09/16
10/01
10/16
10/31
11/15
Date
Temperature (°F)


Beet Rd (WW5)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
06/09
06/27
07/15
08/02
08/20
09/07
09/25
10/13
10/31
11/18
Temperature (F)


Swegle Rd (WW8)
Min/Max
Mean
90
85
80
75
70
65
60
55
50
45
40
06/09
06/27
07/15
08/02
08/20
09/07
09/25
10/13
10/31
11/18
Date
Temperature (F)


Detour Rd (WW9)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
06/09 06/27 07/15 08/02 08/20 09/07 09/25 10/13 10/31 11/18
Date
Temperature (F)

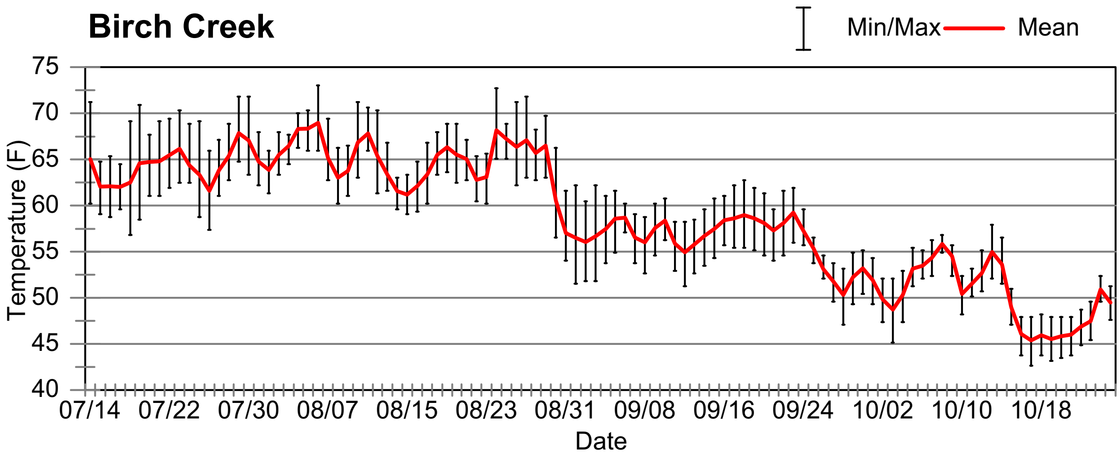

McDonald Rd (WW10)
MIN/MAX
MEAN
85
80
75
70
65
60
55
50
45
40
07/12 07/21 07/30 08/08 08/17 08/26 09/04 09/13 09/22 10/01 10/10 10/19 10/28 11/06 11/15
Date
Temperature (°F)

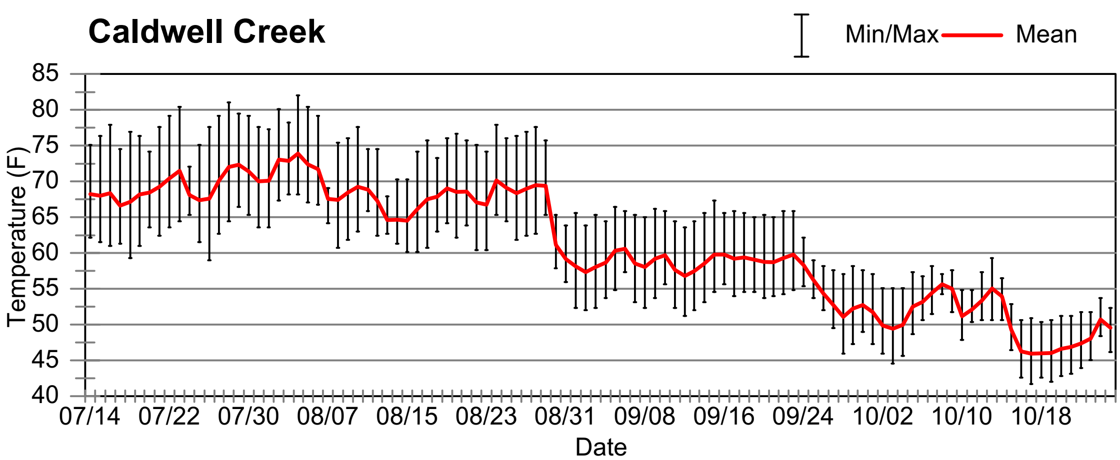

Barney Rd (WW 12)
MIN/MAX
MEAN
90
80
70
60
50
40
07/12 07/23 08/03 08/14 08/25 09/05 09/16 09/27 10/08 10/19 10/30 11/10 11/21
Date
Temperature (F)

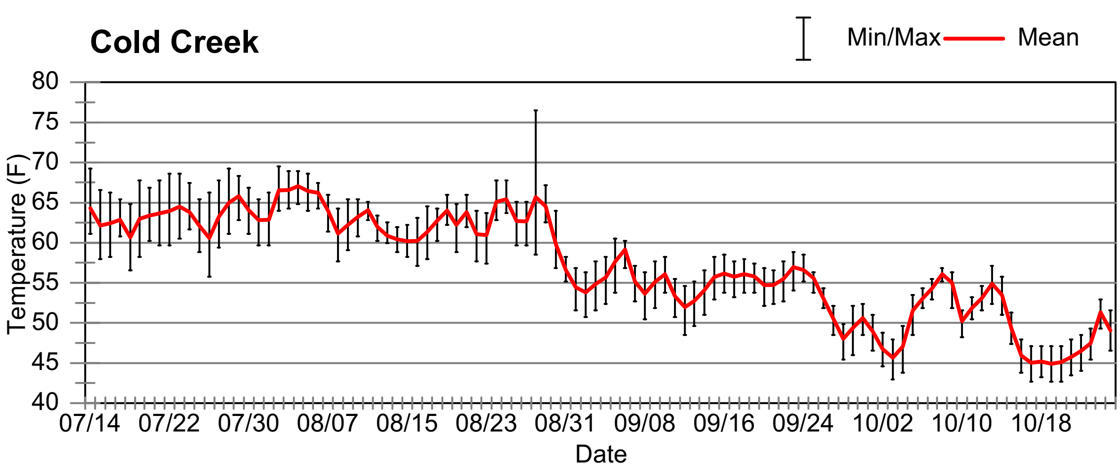
Appendix C1. Additional Stream Temperature Graphs 1999

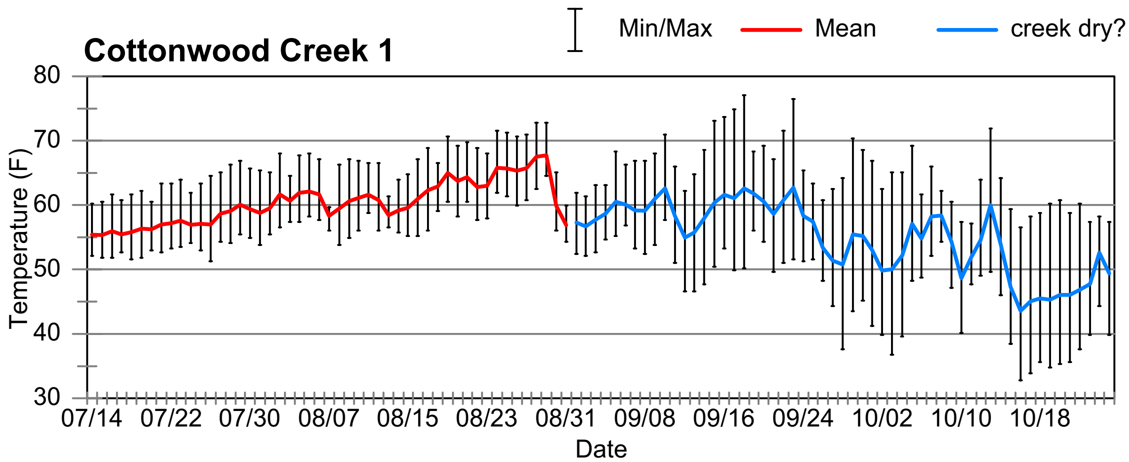
Temperature data provided by Army Corp of Engineers (Ben Tice)
and The Walla Walla Conservation District

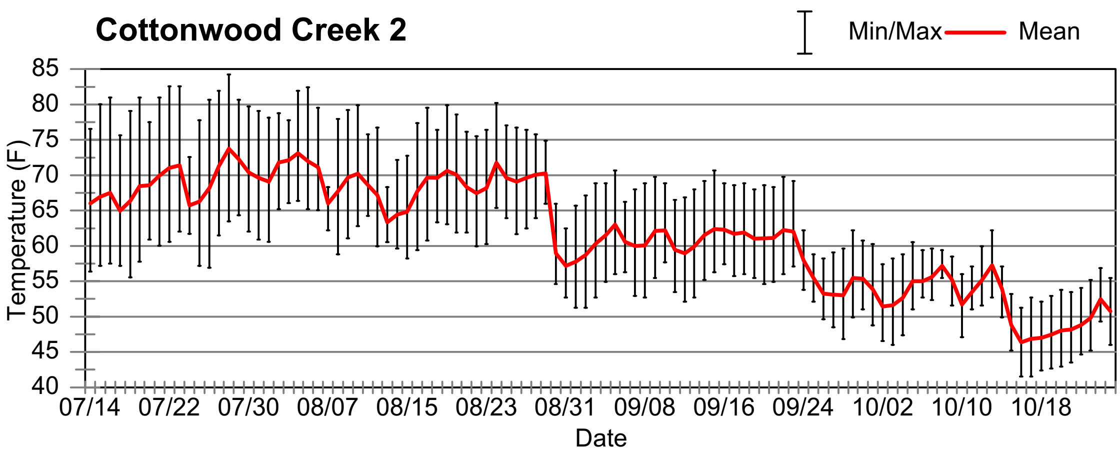
COE/WWCD Temperature Monitors, 1999.				
Stream Name	**Site Name**	**Type**	**Location**	**Comments**
Birch Creek	Pepper Rd	Temp	T6N, R35E, S13, NW¼	In-7/13/1999
Caldwell Creek	S. Second	Temp	T7N, R36E, S33, SW¼	In-7/13/1999
Cold Creek	Last Chance Rd	Temp	T7N, R35E, S32, NE¼	In-7/13/1999
Cottonwood Creek 1	Plaza Way	Temp	T6N, R36E, S6, SE¼	In-7/13/1999
Cottonwood Creek 2	Hood Rd	Temp	T6N, R36E, S11, SW¼	In-7/13/1999
Doan Creek	Whitman Mission	Temp	T7N, R35E, S38, NE¼	In-7/13/1999
East Little Walla Walla	Springdale Rd	Temp	T6N, R35E, S38, SW¼	In-7/13/1999
Garrison Creek 1	Majonnier	Temp	T6N, R35E, S3, SW¼	In-7/13/1999
Garrison Creek 2	Pi-Hi	Temp	T7N, R35E, S38, NE¼	In-8/5/1999
Mill Creek 1	Whitman Mission	Temp	T7N, R36E, S21, SE¼	In-8/5/1999
Mill Creek 2	5-mile Rd	Temp	T7N, R37E, S18, NE¼	In-8/5/1999
Mud Creek 1	Barney Rd	Temp	T7N, R34E, S31, SW¼	In-7/20/1999
Mud Creek 2	Private drive off Locher	Temp	T6N, R35E, S7, NE¼	In-7/13/1999
Pine Creek 1	Sand Pit Rd	Temp	T6N, R33E, S1, NW¼	In-7/20/1999
Pine Creek 2	Stateline Rd	Temp	T6N, R34E, S17, NW¼	In-7/20/1999
Reser Creek			T7N, R36E, S34, SW¼	7/13/99 Dry
Russell Creek 1	Plaza Way	Temp	T6N, R36E, S5, NW¼	In-7/13/1999
Russell Creek 2	Russell Creek Rd	Temp	T7N, R37E, S29, SW¼	In-7/13/1999
Spring Creek	Rt 12 bridge	Temp	T7N, R37E, S5, NW¼	In-7/13/1999
Stone Creek	Tiatan, @ 3rd	Temp	T7N, R36E, S29, SW¼	In-7/13/1999
Titus Creek	5-mile Rd	Temp	T7N, R37E, S18, NE¼	In-7/13/1999
West Little Walla Walla	Stoval Rd	Temp	T7N, R35E, S38, SW¼	In-7/13/1999
Temperature times may be rounded to the nearest 30 minutes.				

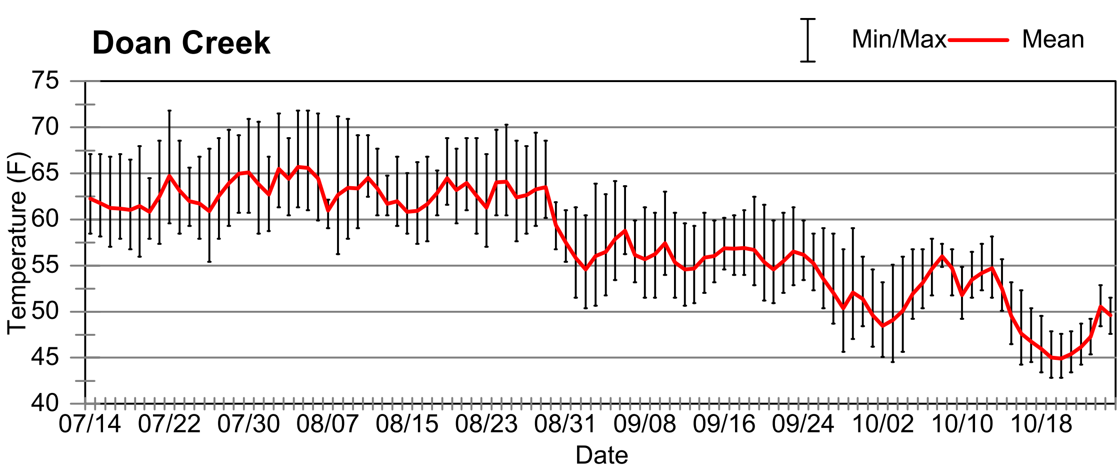

Birch Creek
Min/Max
Mean
75
70
65
60
55
50
45
40
Temperature (F)
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

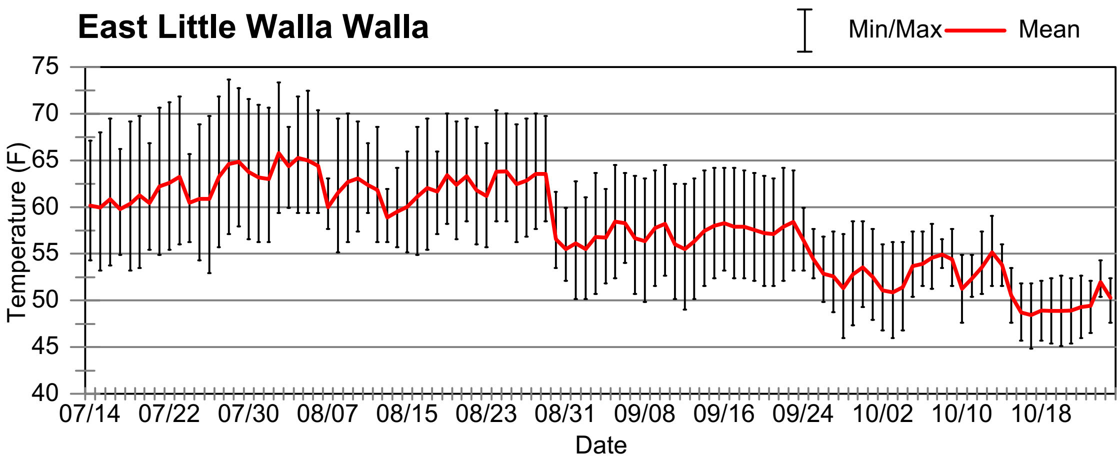

Caldwell Creek
Min/Max
Mean
85
80
75
70
65
60
55
50
45
40
Temperature (F)
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

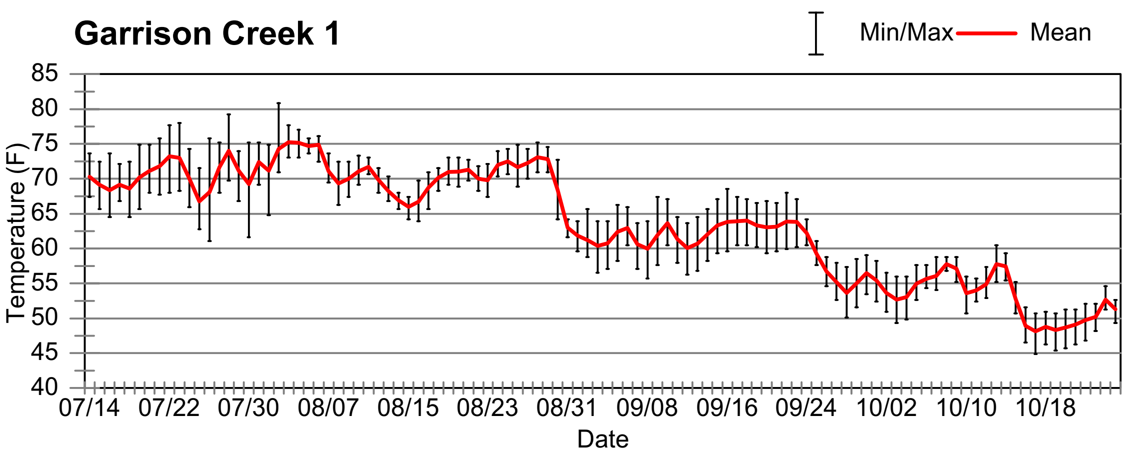

Cold Creek
Min/Max
Mean
80
75
70
65
60
55
50
45
40
Temperature (F)
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

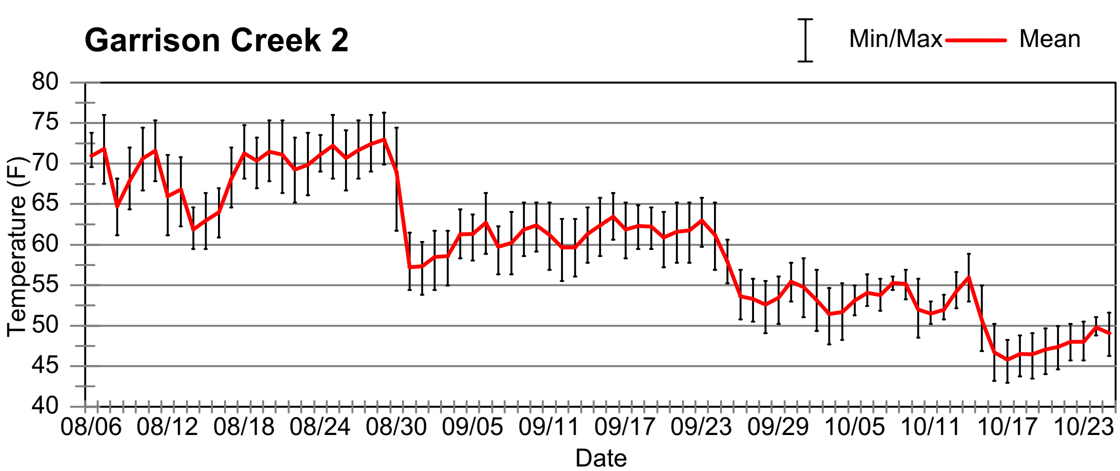

Cottonwood Creek 1
Min/Max
Mean
creek dry?
Temperature (F)
80
70
60
50
40
30
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

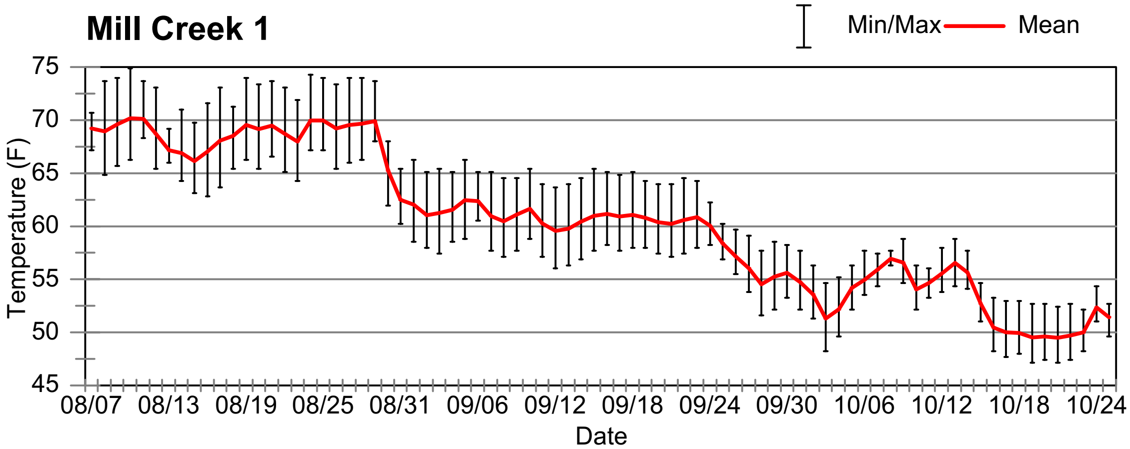

Cottonwood Creek 2
Min/Max
Mean
Temperature (F)
85
80
75
70
65
60
55
50
45
40
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

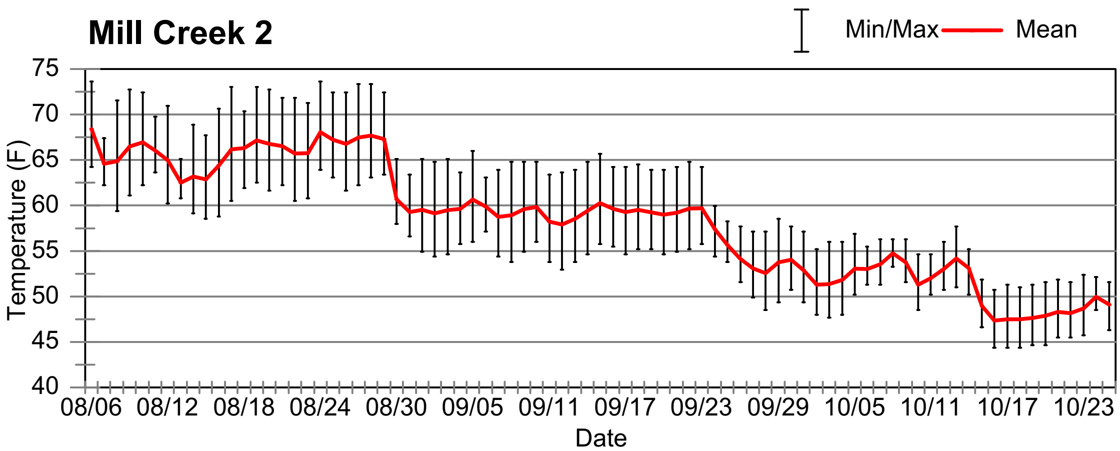

Doan Creek
Min/Max
Mean
Temperature (F)
75
70
65
60
55
50
45
40
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

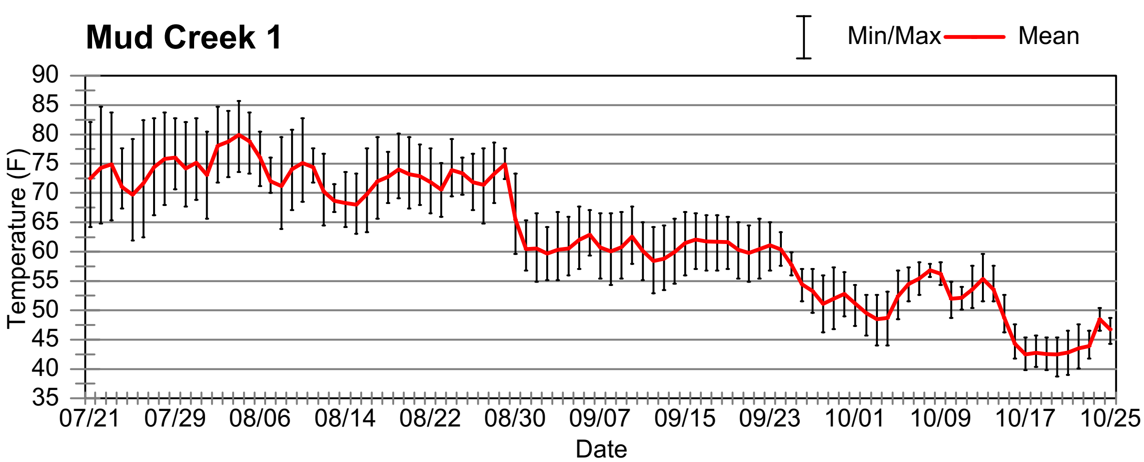

East Little Walla Walla
Min/Max
Mean
Temperature (F)
75
70
65
60
55
50
45
40
07/14 07/22 07/30 08/07 08/15 08/23 08/31 09/08 09/16 09/24 10/02 10/10 10/18
Date

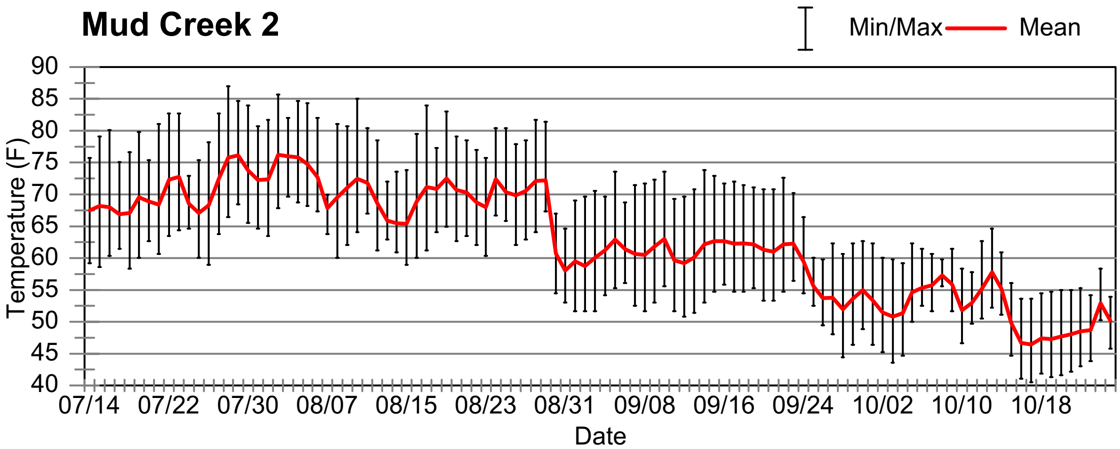

Garrison Creek 1
Min/Max
Mean
Temperature (F)
85
80
75
70
65
60
55
50
45
40
07/14 07/22 07/30 08/07 08/15 08/23 08/31 09/08 09/16 09/24 10/02 10/10 10/18
Date

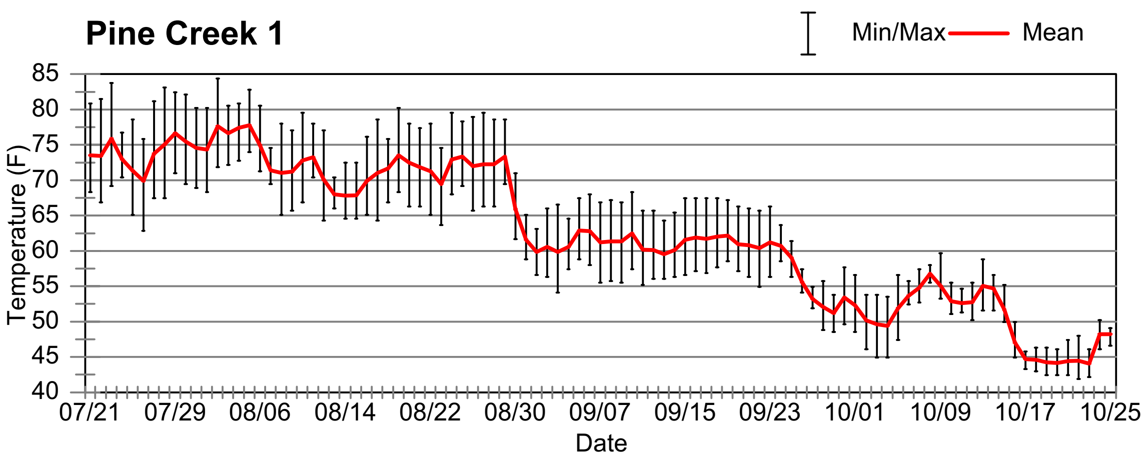

Garrison Creek 2
Min/Max
Mean
Temperature (F)
80
75
70
65
60
55
50
45
40
08/06 08/12 08/18 08/24 08/30 09/05 09/11 09/17 09/23 09/29 10/05 10/11 10/17 10/23
Date

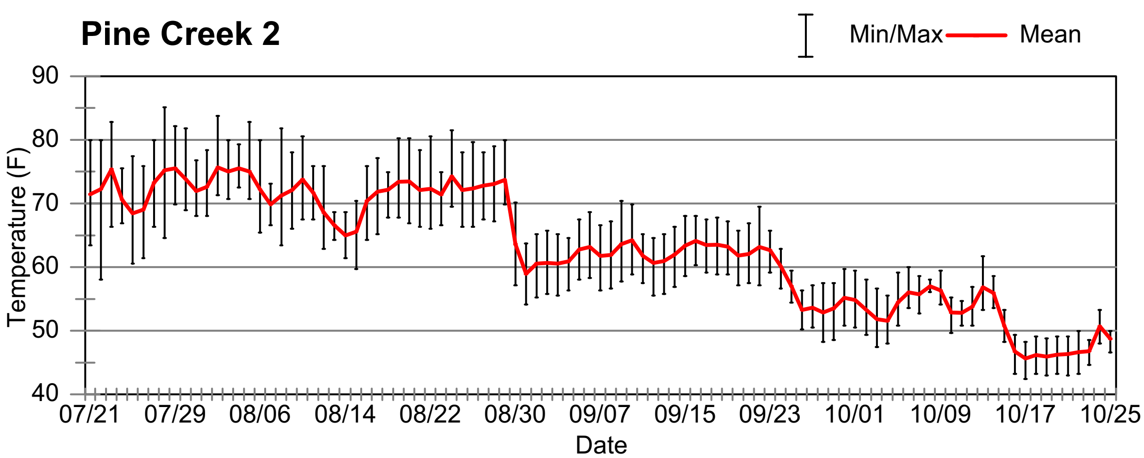

Mill Creek 1
Min/Max
Mean
Temperature (F)
75
70
65
60
55
50
45
08/07 08/13 08/19 08/25 08/31 09/06 09/12 09/18 09/24 09/30 10/06 10/12 10/18 10/24
Date

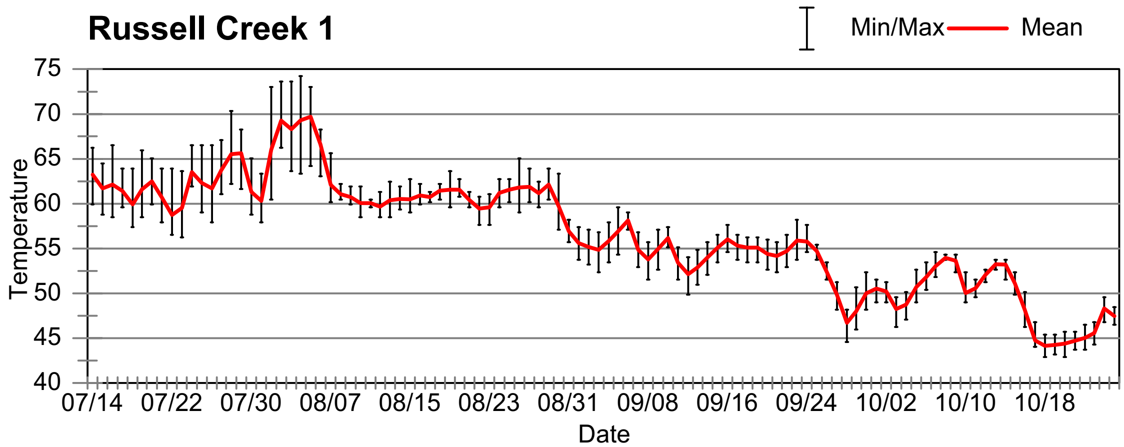

Mill Creek 2
Min/Max
Mean
Temperature (F)
75
70
65
60
55
50
45
40
08/06 08/12 08/18 08/24 08/30 09/05 09/11 09/17 09/23 09/29 10/05 10/11 10/17 10/23
Date

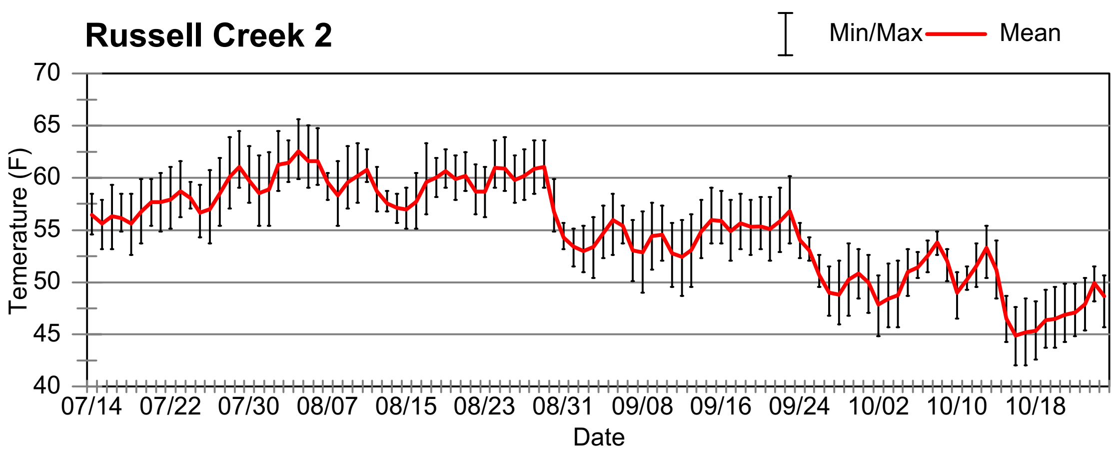

Mud Creek 1
Min/Max
Mean
Temperature (F)
90
85
80
75
70
65
60
55
50
45
40
35
07/21 07/29 08/06 08/14 08/22 08/30 09/07 09/15 09/23 10/01 10/09 10/17 10/25
Date

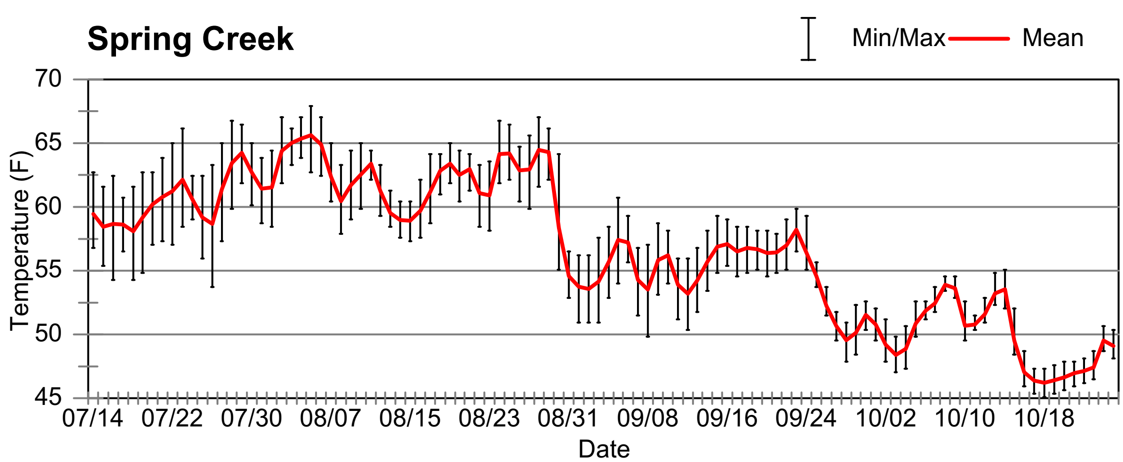

Mud Creek 2
Min/Max
Mean
Temperature (F)
90
85
80
75
70
65
60
55
50
45
40
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date

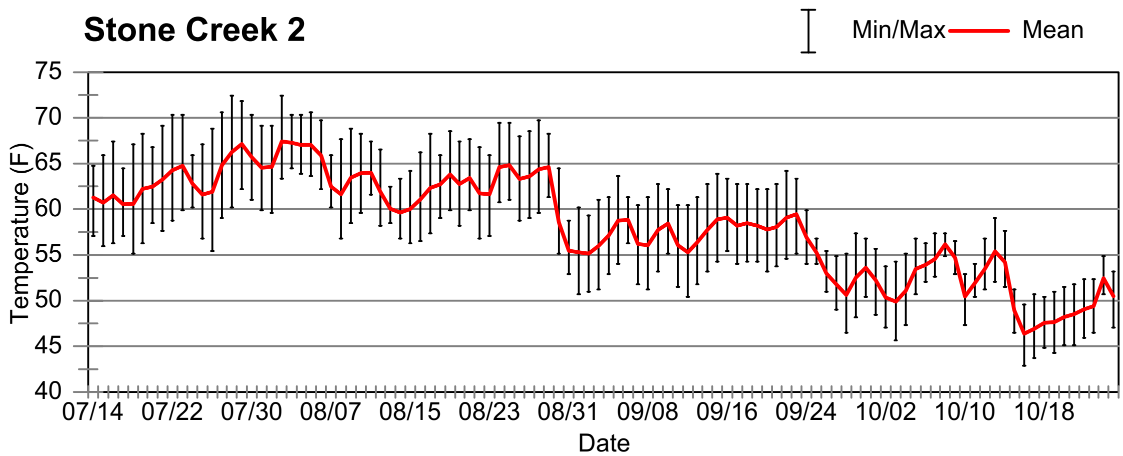

Pine Creek 1
Min/Max
Mean
Temperature (F)
85
80
75
70
65
60
55
50
45
40
07/21
07/29
08/06
08/14
08/22
08/30
09/07
09/15
09/23
10/01
10/09
10/17
10/25
Date

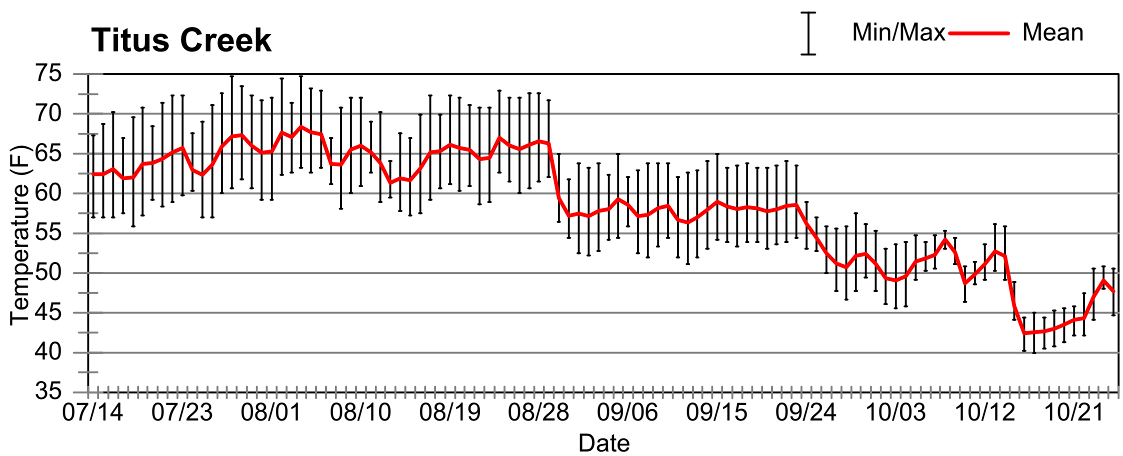

Pine Creek 2
Min/Max
Mean
Temperature (F)
90
80
70
60
50
40
07/21
07/29
08/06
08/14
08/22
08/30
09/07
09/15
09/23
10/01
10/09
10/17
10/25
Date

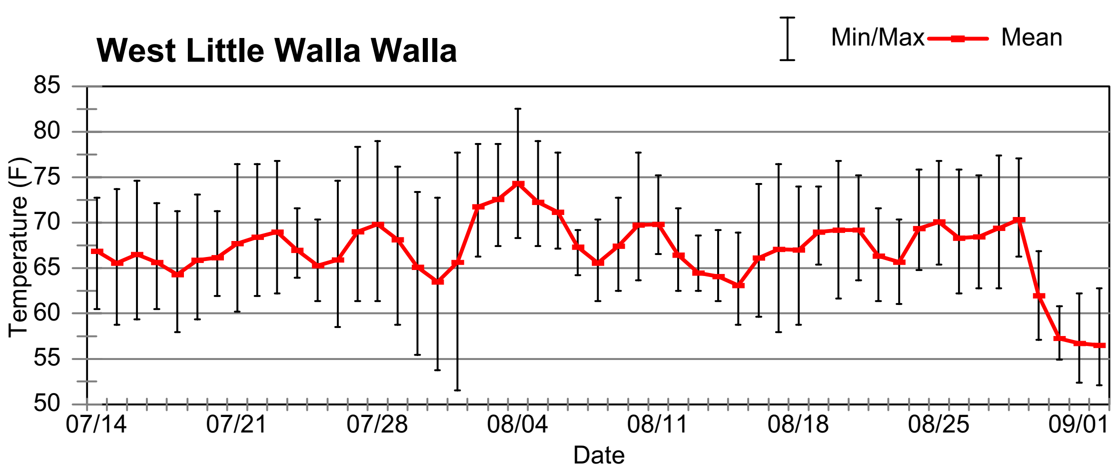

Russell Creek 1
Min/Max
Mean
75
70
65
60
55
50
45
40
Temperature
07/14 07/22 07/30 08/07 08/15 08/23 08/31 09/08 09/16 09/24 10/02 10/10 10/18
Date


Russell Creek 2
Min/Max
Mean
70
65
60
55
50
45
40
Temerature (F)
07/14 07/22 07/30 08/07 08/15 08/23 08/31 09/08 09/16 09/24 10/02 10/10 10/18
Date


Spring Creek
Min/Max
Mean
70
65
60
55
50
45
Temperature (F)
07/14 07/22 07/30 08/07 08/15 08/23 08/31 09/08 09/16 09/24 10/02 10/10 10/18
Date


Stone Creek 2
Min/Max
Mean
75
70
65
60
55
50
45
40
Temperature (F)
07/14
07/22
07/30
08/07
08/15
08/23
08/31
09/08
09/16
09/24
10/02
10/10
10/18
Date


Titus Creek
Min/Max
Mean
75
70
65
60
55
50
45
40
35
Temperature (F)
07/14
07/23
08/01
08/10
08/19
08/28
09/06
09/15
09/24
10/03
10/12
10/21
Date


West Little Walla Walla
Min/Max
Mean
85
80
75
70
65
60
55
50
Temperature (F)
07/14
07/21
07/28
08/04
08/11
08/18
08/25
09/01
Date

Appendix D. Water Quality Data 1999

Appendix D: Table 1. Water quality data for the Walla Walla and Touchet Rivers collected by WDOE, May - October 1999.

Stream/ Station	Date	Time	Temp. °C	Conductivity (umhos/cm)	Oxygen (mg/L)	% Satur- ation	pH	Suspended Solids (mg/L)	Total Persulphate Nitrogen (mg/L)
Walla Walla River									
32A070	05/12	0805	9.7	120	10.0	88.7	8.3	29	0.604
Near	06/15	1730	25.3	176	9.1	113.0	8.2	17	0.77
Touchet	07/06	1600	24.0	230	12.6	152.3	9.0	18	0.572
	08/03	1700	25.2	407	14.3	175.5	9.0	33	0.885
	09/07	1745	18.0	309	12.6	134.1	8.6	18	0.732
	10/13	1005	10.8	264	10.2	92.7	8.0	19	0.587
32A100	05/12	0945	9.4	98	12.1	107.2	8.3	11	0.668
At	06/15	1750	24.8	156	8.4	103.4	8.1	8	1.03
Detour	07/06	1640	24.6	306	11.3	138.6	8.1	3	0.614
Rd. Br.	08/03	1815	24.2	167	9.1	110.4	8.8	7	0.66
	09/07	1845	16.5	173	9.8	101.8	8.5	6	0.645
	10/13	0730	9.9	222	9.3	83.1	7.9	4	1.7
Touchet River									
32B080	05/12	1040	11.2	82	11.0	101.9	8.6	15	0.275
At	06/16	0755	20.6	88	8.3	93.8	7.8	23	0.525
Simms	07/07	0830	17.9	100	8.9	95.1	8.0	9	0.306
Rd. Br.	08/04	0800	22.6	120	7.4	88.8	7.9	5	0.282
	09/08	0815	12.7	119	9.9	94.5	8.0	2	0.157
	10/13	0920	10.1	115	10.4	93.6	8.2	3	0.164
32B100	5/12	1150	9.8	73	13.0	119.0	9.3	8	0.359
At Bolles	06/16	0630	15.4	79	9.0	93.3	7.8	16	0.555
Br.	07/07	0730	14.8	101	10.4	106.5	8.1	9	0.436
	08/04	0645	19.2	112	7.4	82.6	7.7	10	0.529
	09/08	0700	10.7	112	9.8	91.0	7.9	6	0.302
	10/13	0830	9.3	111	10.8	97.2	8.1	5	0.416

Appendix D: Table 1. Water quality data for the Walla Walla and Touchet Rivers collected by WDOE, May - October 1999 (continued).

Stream/ Station	Date	Time	Ammonia Nitrogen (mg/L)	Total Phosphorus (mg/L)	Dissolved Soluble P (mg/L)	Turbidity (NTU)	Fecal Coliforms (#/100ml)	Nitrate - Nitrite (mg/L)
Walla Walla River								
32A070	05/12	0805	0.031	0.091	0.028	8.2	80	0.328
Near Touchet	06/15	1730	0.057	0.149	0.065	8.1	380	0.453
	07/06	1600	0.039	0.117	0.04	7.4	77	0.168
	08/03	1700	0.043	0.121	0.022	15.0	64	0.13
	09/07	1745	0.047	0.142	0.072	8.7	27	0.537
	10/13	1005	0.01[b]	0.13	0.06	7.3	28	0.335
32A100	05/12	0945	0.029	0.108	0.048	6.3	98	0.418
At Detour Rd. Br.	06/15	1750	0.05	0.163	0.096	2.7	NA[a]	0.521
	07/06	1640	0.055	0.131	0.073	1.5	150	0.329
	08/03	1815	0.049	0.201	0.144	3.0	280	0.331
	09/07	1845	0.045	0.146	0.086	2.3	60	0.53
	10/13	0730	0.042	0.239	0.152	1.8	99	1.45
Touchet River								
32B080	05/12	1040	0.025	0.054	0.007	6.6	5	0.01[b]
At Simms Rd. Br.	06/16	0755	0.047	0.12	0.055	10.0	110	0.22
	07/07	0830	0.041	0.107	0.054	3.7	110	0.012
	08/04	0800	0.04	0.147	0.095	2.4	85	0.01[b]
	09/08	0815	0.036	0.115	0.065	2.2	31	0.01[b]
	10/13	0920	0.01[b]	0.093	0.04	2.4	23	0.01[b]
32B100	05/12	1150	0.016	0.068	0.016	3.7	51	0.141
At Bolles Br.	06/16	0630	0.041	0.093	0.039	4.7	290	NA[a]
	07/07	0730	0.043	0.072	0.027	1.6	96	0.202
	08/04	0645	0.039	0.117	0.061	5.4	210	0.248
	09/08	0700	0.04	0.106	0.05	3.3	89	0.182
	10/13	0830	0.01[b]	0.094	0.04	1.8	43	0.259

[a] Missing Data

[b] Only trace amounts were detected.

Appendix D: Table 2. Temperature, oxygen , and pH data that exceeded state water quality standards for the Walla Walla and Touchet rivers, 1999.

Stream	River Class	WDOE Station ID	WDFW Site ID	Date	Time	Criteria[a]	Sample Result	% exceeds Standard
Walla Walla R near Touchet	B	32A070	- -	6/15	17:30	Temp > 21C	25.3	20.5
				7/6	16:00	pH > 8.5	9.0	5.9
				7/6	16:00	Temp > 21C	24.0	14.3
				8/3	17:00	pH > 8.5	9.0	5.9
				8/3	17:00	Temp > 21C	25.2	20.0
				9/7	17:45	pH > 8.5	8.6	1.2
Walla Walla R @ Detour Rd	A	32A100	WW-9	6/15	17:30	Temp > 18C	24.8	37.8
				7/6	16:40	Temp > 18C	24.6	36.7
				8/3	18:15	pH > 8.5	8.8	3.5
				8/3	18:15	Temp > 18C	24.2	34.4
Touchet R @ Bolles Brg	A	32B100	TR-13	5/12	11:50	pH > 8.5	9.3	9.4
				8/4	6:45	Oxygen ≤ 8mg/l	7.4	8.1
				8/4	6:45	Temp > 18C	19.2	6.7
Touchet R @ Simms Rd Br	A	32B080	TR-16	5/12	10:40	pH > 8.5	9.3	9.4
				6/16	7:55	Temp > 18C	26.6	14.4
				8/4	8:00	Oxygen ≤ 8mg/l	7.4	8.1
				8/4	8:00	Temp > 18C	22.6	56.6

[a] Represents approximate water quality standards for oxygen, pH, or temperature. For more information see *Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington*

Appendix D. Table 3. Miscellaneous Water Quality Field Data 1999.

Date	Stream	Site #	pH	Conductivity (umhos/cm)	Turbidity (NTU)	D.O. (mg/L)
9-9-99	SF Touchet	SFT-7	8.16 Temp (C) 17.1 Time 12:07	76.7 Temp (C) 17.6 Time 12:07	27.9 NTU Temp (F) 63 Time 12:07	- -
10-14-99	SF Touchet	SFT-7	7.26 Temp (C) 13.4 Time 15:18	64.3 Temp (C) 13.5 Time 15:18	- -	
9-9-99	SF Patit Crk	SFP-2	8.07 Temp (C) 9.9 Time 10:37	91.8 Temp (C) 10.1 Time 10:37	2.7 NTU Temp (F) 49 Time 9:55	
8-18-99	SF Patit Crk	SFP-3	7.66 Temp (C) 19.6 Time 16:30	27.6 Temp (C) 20.0 Time 16:30	3.1 NTU Temp (F) 67 Time 16:30	
8-11-99	Touchet R	TR-3	7.96 Temp (C) 19.3 Time 12:05	28.7 Temp (C) 19.6 Time 12:10	3.4 NTU Temp (F) 66 Time 12:10	
8-3-99	Touchet R	TR-11	8.28 Temp (C) 21.1 Time 9:30	88.3 Temp (C) 21.7 Time 9:42	- -	
8-11-99	Touchet R	TR-13	7.63 Temp (C) 19.3 Time 8:35	41.7 Temp (C) 19.5 Time 8:40	4.1 NTU Temp (F) 68 Time 8:30	
8-11-99	Touchet R	TR-16	7.96 Temp (C) 22.9 Time 9:50	42.4 Temp (C) 23.2 Time 9:55	2.6 NTU Temp (F) 74 Time 9:45	
8-11-99	Touchet R	TR-17	7.70 Temp (C) 22.6 Time 10:30	46.5 Temp (C) 22.9 Time 10:35	3.0 NTU Temp (F) 74 Time 10:35	
8-9-99	SF Coppei	SFC-4	7.77 Temp (C) 18.8 Time11:15	36.7 Temp (C) 19.5 Time 11:20	2.3 NTU Temp (F) 67 Time 11:50	
8-9-99	NF Coppei	NFC-4	8.03 Temp (C) 18.7 Time 11:45	42.5 Temp (C) 19.3 Time 11:50	2.7 NTU - - - -	
8-10-99	Dry Creek	DC-1	8.01 Temp (C) 17.9 Time 10:30	36.5 Temp (C) 18.4 Time 10:20	- -	
8-10-99	Dry Creek	DC-2	6.75 Temp (C) 22.3 Time 11:40	36.2 Temp (C) 22.0 Time 11:40	3.1 NTU Temp (C) 68 Time 11:45	
8-10-99	Dry Creek	DC-3	8.66 Temp (C) 21.0 Time 13:10	50.4 Temp (C) 21.1 Time 13:15	2.0 NTU - - - -	

Appendix D. Table 3. Miscellaneous Water Quality Field Data 1999 (continued).						
Date	**Stream**	**Site #**	**pH**	**Conductivity (umhos/cm)**	**Turbidity (NTU)**	**D.O. (mg/L)**
10-18-99	NF Dry Crk	NFD-2	7.1 Temp (C) 8.7 Time 14:20	- - Temp (F) 46 Time 14:21	1.6 NTU Temp (F) 46 Time 14:21	13.5
8-9-99	Walla Walla	WW-1	8.0 Temp (C) 22.8 Time 14:40	73.0 Temp (C) 23.3 Time 14:50	- -	- -
8-4-99	Walla Walla	WW-1	7.62 Temp (C) 21.1 Time 9:38	89.1 Temp (C) 21.7 Time 9:36	- -	- -
10-18-99	Walla Walla	WW-1	7.85 Temp (C) 10 Time 10:53	20.1 Temp (C) 10.4 Time 10:53	2.1 Temp (F) 51 Time 10:42	Temp (F) 51 Time 10:42
8-4-99	Walla Walla	WW-2	8.95 Temp (C) 24.5 Time 11:23	89.8 Temp (C) 25.0 Time 11:23	- -	
8-9-99	Walla Walla	WW-5	8.57 Temp (C) 23.7 Time 15:30	49.0 Temp (C) 24.0 Time 15:35	4.8 - - - -	
10-18-99	Walla Walla	WW-5	7.62 Temp (C) 8.7 Time 11:29	127.7 Temp (C) 8.9 Time 11:29	2.9 Temp (F) 48 Time 11:20	13 Temp (F) 48 Time 11:24
8-4-99	Walla Walla	WW-6	8.42 Temp (C) 26.7 Time 15:05	53.8 Temp (C) 26.8 Time 16:08	- -	
8-9-99	Walla Walla	WW-8	8.84 Temp (C) 24.8 Time 16:10	53.0 Temp (C) 25.0 Time 16:15	4.8 - - - -	
8-10-99	Walla Walla	WW-9	8.97 Temp (C) 25.5 Time 14:50	61.2 Temp (C) 25.8 Time 14:50	3.4 Temp (F) 78 Time 14:50	
10-18-99	Walla Walla	WW-9	8.13 Temp (C) 10.5 Time 12:14	- -	2.3 Temp (F) 49.5 Time 12:05	> 15 Temp (F) 49.5 Time 12:05
10-18-99	Walla Walla	WW-11	7.67 Temp (C) 12.6	- -	1.9 Temp (F) 53.5	> 15 Temp (F) 53.3
10-15-99	McKay Crk	MK-1	8.15 Temp (C) 7.0 Time 10:58	351.0 Temp (C) 8.04 Time 10:58	1.7 - -	12.1 - -
10-18-99	Whetstone	W-1	8.1 Temp (C) 6.1 Time 11:28	392.0 Temp (C) 6.4 Time 11:28	9.1 Temp (F) 42.5 Time 11:18	13.4 Temp (F) 42.5

Appendix E. Qualitative Electrofishing 1999

Appendix E. Table 1. Qualitative Electrofishing Sites, 1999.

		Salmonid (RBT, BT, BRT)[a]	
Reach	**Site***	**Relative Abundance**	**Other Species Relative Abundance**[b]
NF Touchet	NFT-5*	4 age classes of RBTs with many 1+ fish. One BT (380 mm)	
	NFT-6*	3 age classes of RBTs, RBTs common	Sculpin - common
	NFT-8*	4 age classes of RBTs, RBTs common. One BRT (660 mm)	Sculpin - common
	NFT-9*	4 age classes of RBTs with 0+ and 1+ common	Sculpin - common
	NFT-10*	4 age classes of RBTs, RBTs abundant, BRT rare	Sculpin - common
	NFT-11*	4 age classes of RBTs, 1+ common One BRT (355 mm), and one BT (176 mm)	Sculpin - common
	NFT-13*	4 age classes of RBTs, RBTs common, one BRT (660 mm)	Sculpin - common
Lewis Crk	LC-1	RBTs rare, becoming common below large debris jam, one BT (231 mm)	Tailed frogs - rare
	LC-5	RBTs rare below culvert, none above	
Jim Crk	JC-1	0+, 1+, RBTs uncommon, $\geq$8 in RBTs rare	Crayfish - uncommon
Wolf Fork	WF-6*	4 age classes of RBTs, RBTs common	Sculpin - common, dace - uncommon
	WF-8*	4 age classes of RBTs, some large brown trout	Mountain Whitefish - rare, Sculpin - abundant
Coates Crk	C-1 C-4	1+ RBTs common Three age classes of RBTs	Tailed frogs - rare
Robinson Fk	RF-1	0+ RBTs uncommon, 1+ RBTs common, $\geq$8 in rare	Margined sculpin - uncommon, Piute sculpin - common
	RF-3	3 age classes of RBTs	Margined and Piute sculpin common
Green Fork	GF-1	No salmonids present	
	GF-2	0+ uncommon, 1+ common	crayfish - uncommon, Sculpin - common
	GF-3	0+ and 1+ RBT's common, $\geq$8 in rare	
	GF-4	0+ and $\geq$8 rare, 1+ common	Sculpin - rare

[a] RBT; Rainbow Trout, BRT; Brown Trout, BT; Bull Trout
[b] Relative adundance categories found in Appendix F.

* Rainbow/steelhead collected for DNA Analysis.

Appendix E. Table 1. Qualitative Electrofishing Sites, 1999 (continued).

		Salmonid (RBT, BT, BRT)[a]	
Reach	**Site***	**Relative Abundance**	**Other Species Relative Abundance[b]**
Burnt Fork	BF-1	3 age classes of RBTs, some large 10" - 12" RBTs	Sculpins - uncommon, Tailed frogs - rare
SF Touchet	SFT-5*	0+ RBTs between 50mm & 110mm common, 1+ RBTs common. Two hatchery STH at 210 & 212mm	shiners and dace - common crayfish and sculpins - uncommon
SF Touchet	SFT-7*	4 age classes of salmonids, RBTs common, one BRT (392 mm)	Sculpins - common
Patit Creek	PC-1	0+ RBTs common	Dace - abundant
SF Patit	SFP-1	0+ and 1+ RBTs common	Sculpin - rare
	SFP-5	No salmonids present	Dace - abundant
Whiskey Crk	WC-1	No salmonids	Abundant dace
	WC-2	0+ RBTs common	Dace and Red-side shiners present
NF Coppei	NFC-1	1+ RBT's uncommon, >8 in rare	
Dry Crk	DC-6	0+ RBTs common, 1+ RBTs	Dace, Red-side shiners, chiselmouth, squawfish and crayfish present
	DC-7	1+ RBTs uncommon, 0+ RBTs rare	
	DC-8	No salmonids	N. Pike minnows, Bridge-lip suckers, Red-side shiners and dace present
	DC-9	0+ and 1+ RBTs rare	Dace, Red-side shiners, pike minnows, suckers, Margined and Piute sculpins present
	DC-12	No salmonids	Dace and Pike minnows - abundant Red-side shiners - common, chiselmouth uncommon
N Fk Dry Crk	NFD-1	0+ RBT's common, 1+ RBT's rare	Margined sculpin - rare
Mud Crk	MC-1	No salmonids	Sculpin - common
	MC-2	0+ RBTs common	
McKay Crk	MK-1	No salmonids found	crayfish present
Spring Creek (Stonecipher Rd.)		No salmonids found	no fish found

[a] RBT; Rainbow Trout, BRT; Brown Trout, BT; Bull Trout
[b] Relative adundance categories found in Appendix F.

* Rainbow/steelhead collected for DNA Analysis.

Appendix F. Relative Abundance of Non–Salmonids 1999

Appendix F. Table 1a. Relative Abundance - Non- Salmonids 1999 Touchet River & Tributaries											
Species	**N. Fork**	**Lewis Ck**	**Jim Ck**	**Wolf Fork**	**Coates Ck**	**Robinson Fk**	**South Fork**	**Green Fork**	**Burnt Fork**	**S. Fork Patit**	**Patit Ck[b]**
Petromyzontide Lamprey	1[b]	0	1	1	0	1	1	0	1	0	0
Cyprinidae Speckled dace *Rhinichtys osculus*	4[b]	0	0	0	0	3[b]	3	0	1	0	0
Chiselmouth *Acroheilus alutaceus*	0	0	0	0	0	0	0	0	0	0	0
Redside shiner *Richardsonius balteatus*	0	0	0	0	0	0	3	0	0	0	0
Northern pikeminnow *Ptychocheilus oregonesis*	0	0	0	0	0	0	0	0	0	0	0
Catostomidae Suckers[3] *Catostomus sp.*	0	0	0	0	0	0	0	0	0	0	0
Cottidae Piute sculpin *Cottus beldingi*	3[b]	1	2	3[a]	1	3	3	2	2	2	0
Margin sculpin *Cottus marginatus*	2[b]	3	3	3[a]	3	2	2	2	2	2	0
Torrent sculpin *Cottus rhotheus*	0	0	0	0	0	0	0	0	0	0	0
Tailed Frogs *Ascaphus truei*	P	3	0	0	2	1	0	0	1	0	0
Crayfish *Pacifastacus Spp.*	2	0	2	U	1	3	2	1	2	2	0

[a]. Sculpin noted genus only, not identified by species.
[b]. Relative abundance derive from qualitative electrofishing.

Appendix F. Table 1b.	Touchet River							Walla Walla River			
Species	**Touchet Main**	**Whetstone Ck**	**Whiskey Ck**	**Coppei Ck Main**	**SF Coppei Ck**	**NF Coppei Ck**	**Lower Touchet**	**Mud Ck**	**Dry Ck (upper)**	**Dry Ck (mid)**	**Walla Walla**
Petromyzontide Lamprey larvae	3	0	0	1	1	0	1	0	1	2	2
Cyprinidae Speckled dace *Rhinichtys osculus*	4	4	3	4	4	3	4	0	3	4	4
Chiselmouth *Acroheilus alutaceus*	0	0	0	0	0	0	0	0	0	3	3
Redside shiner *Richardsonius balteatus*	2	3	3	1	0	0	3	0	0	3	4
Northern pikeminnow *Ptychocheilus oregonesis*	0	1	0	0	0	0	1	0	0	2	2
Catostomidae Suckers[3] *Catostomus sp.*	0	1	0	0	0	0	1	0	0	1	2
3-spine stickleback *Gasterosteus aculeatus*	0	0	0	0	0	0	0	0	0	0	1
Cottidae Piute sculpin *Cottus beldingi*	3[b]	0	0	0	3[a]	2[a]	3	0	2	0	1
Margin sculpin *Cottus marginatus*	3[b]	0	0	3	3[a]	2[a]	2[b]	2	3		
Torrent sculpin *Cottus rhotheus*	2	0	0	0	1	0	1	0	0	0	3
Crayfish *Pacifastacus Spp.*	3	P	0	3	2	P	3	0	2	2	2

Appendix F. Table 2. Categories of relative abundance.

Category	Count (individuals seen)	Ranking Value (for averaging sites)
Absent	0	0
Rare	1-3	1
Uncommon	4-10	2
Common	11-100	3
Abundant	100+	

P = present,
a. Sculpin noted genus only, not identified by species.
b. Relative abundance derive from qualitative electrofishing.